Chemetco, Incorporated

Hartford, IL

Closure and Post-Closure Plans
Chemetco, Inc. Facility
Hartford, Illinois

ENSR Consulting and Engineering

January 1991

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Response to IEPA Comments of October 19, 1990 on Closure and Post-Closure Plans, Chemetco, Inc., Hartford, Illinois of July 1990.

Comment 1.a: Condition 1.v.b of the April 6, 1990 closure and post-closure plan approval letter required Chemetco to provide a map showing the location of wells MW-7 and MW-21. Chemetco responded by stating the well locations are shown on Figure 3-1. However, Figure 3-1 does not show the location of wells MW-7 and MW-21. This must be corrected.

Response: Figure 3-1 has been revised to include all monitoring wells at the Chemetco Site. Table 3-1 lists the monitoring wells and provides information on the well depth and screening interval.

Comment 1.b: Condition 1.v.d of the April 6, 1990 closure and post-closure plan approval letter required Chemetco to provide the qualitative data which Chemetco is using to determine the effectiveness of the SIDS system. Chemetco responded by stating they will develop a conceptual flow model from water level measurements in monitoring wells around the SIDS system and from local geology. Chemetco must provide the conceptual flow model and all input parameters to the Agency. Also see deficiency number 2.h below.

Response: A comprehensive report, titled "Hydrogeologic Summary, Chemetco Inc., Hartford, Illinois", was prepared to summarize the data collected in the over eight years of field investigations and water quality analyses. The report provides a detailed description of the hydrogeology of the perched zone and the design of the SID system. In addition, the report presents the results of an evaluation of the SID system effectiveness. The evaluation was based on a review of three parameters: (1) water level measurements; (2) a water balance of the water flowing through the sand lense and the water collected in the SID system; and (3) water quality data.

Water levels in monitor wells screened in the perched zone were evaluated in conjuntion with the SID system design. A water table map was developed to show the water levels in the wells screened in the perched zone and the theoretical water level in the SID system, assuming that the water level in the SID system trench is lowered to the bottom of the horizontal pipes. The map shows a steep gradient near the SID system which levels out within a short distance upgradient. The gradient and small area of influence is typical of a passive remediation system.

A water balance was performed based on hydrogeologic data gathered on the Chemetco site and data collected from the SID system. The perched zone hydrogeologic parameters are presented in detail in Section 4 of the "Hydrogeologic Report". Based on the data, the ground water flow through the sand lense was calculated to be 7,000 gallons per day (GPD). This flow rate was compared with the data collected from the SID system. The volume of water recovered from the SID system is calculated by multiplying the hours that the water level-activated pump operates by the pump design rate. Records of weekly readings of the pump usage meter indicate that the volume of water withdrawn ranges from 4,000 to 12,000 GPD. Fluctuations in withdrawal rates are related to changes in the flow rate through the sand lense, a function of the lense recharge rate by precipitation. The volume of water withdrawn is in the same order of magnitude as the calculated flow rate through the sand lense. This water balance indicates that the SID system is effectively intercepting the sand lense.

Water quality analyses are periodically conducted on the water collected in the SID system. Analytical results indicate that the water quality has improved slightly. Large improvement in the water quality is not expected until the pH of the water in the sand lense increases to more neutral levels. The system is not designed to remediate the collected ground water, but rather to prevent the flow of contaminated ground water to the surface and subsequent downgradient contamination of soils.

Additional information on the effectiveness of the SID system is presented in the "Hydrogeologic Summary".

Comment 1.c: In Condition 1.v.h the Agency asked if the assumptions made about the well designation was correct. Chemetco responded by stating a revised list of monitoring wells is provided as Table 3-2. However, Chemetco did not provide an explanation why they had deleted previously approved monitoring wells. This must be provided to the Agency or the wells must stay in the monitoring program.

Response: The monitoring wells selected include those previously approved with two exceptions. The first, well 3A, is screened in the upper zone of the regional aquifer. Well 3A was replaced by wells 34 and 47. Wells 34 and 47 were installed in April 1990, after well 3A was approved. These wells are located closer to the point of compliance than well 3A and at the 200 foot interval requested by IEPA. The second, well 22, is located 200 feet north of the northeastern corner of the facility boundary. The well is not downgradient of the facility and would not provide useful monitoring data unless used as a background well. Well 11 was selected and approved as a background well. Therefore well 22 was omitted from the monitoring program.

Several of the wells were renumbered in the course of field investigations. For example, wells C1-S through C8-S were renumbered as 22 through 29. Former well designations for those wells that were renumbered are noted in parentheses following the present well number in Table 3-1. In addition, wells I-2 through I-6 that were proposed previously were to be installed the point of compliance. Upon installation, the wells were numbered; the previously proposed wells are the same as those installed: 37, 35, 34, 47, and 44.

Comment 1.d: Condition 1.v.i required that monitor well construction of any well shall meet current Agency guidelines. Chemetco responded by stating recently installed wells meet Agency guidelines and if any additional wells are required in the future, the wells shall be installed to conform to Agency guidelines. However, the Agency cannot evaluate if the wells are installed to Agency specifications since the boring logs were not submitted. It should be noted that the Appendix I analysis of the zinc oxide and the floor wash impoundment detected organics. Pursuant to IEPA, DLPC Policy, any monitoring well installed to monitor a plume with the potential of organic contamination shall be constructed of inert material, (i.e. stainless steel or teflon). Chemetco must demonstrate they meet or provide a schedule to meet this requirement for all monitoring wells at the facility.

Response: Organic compounds have not been detected above reportable levels in the ground water in either the regional aquifer or the perched unit. Therefore, wells installed at the Chemetco facility were not constructed of inert material, One stainless steel well was installed in the perched zone beneath the contaminant source in order to detect organic compounds that may have leached from the closed unit. If analyses determine that organics are leaching to the ground water, additional stainless steel or teflon wells may be proposed to assess the rate and extent of migration of organic compounds. The need for stainless steel or teflon wells was discussed with Cindy Davis. As agreed, stainless steel or teflon wells are not warranted at this time.

Comment 1.e: Condition 1.v.j of the April 6, 1990 closure and post-closure plan approval letter required Chemetco to provide a map showing the point of compliance clearly indicated. Chemetco responded by stating Figure 3-2 shows the point of compliance. However, Figure 3-2 does not clearly indicate the requested information. Also, the point of compliance as used in Chemetco's interim status closure plan and post-closure plans is not to be confused with the definition of point of compliance as defined in 35 IAC Section 724.195. Specifically the point to be monitored for the upper zone shall be the area immediately south of the SIDS system and the facility's eastern fence along its southern extent, as defined in Chemetco's January 1990 closure and post-closure plan. The point to be monitored is not to include the contamination detected east of the facility's eastern fence along its southern extent. An assessment plan to define the rate, extent and concentration under 35 IAC Section 725.193(d)(4) and a remedial action plan to address the release to the east of the facility's eastern fence line shall be included in the response to this denial.

Reponse:

1. Figure 3-2 has been revised to demarcate the point of compliance for the perched unit and the regional aquifer as the SID system and

the eastern facility boundary, and the north and northwestern facility boundary, respectively.

2. Recent investigations indicate that well 12, where the referenced contamination was detected, is located at a transition zone between the eastern boundary of the large sand lense in the southeastern quadrant of Chemetco and another sand lense. Water level measurements in wells east and southeast of well 12 indicate that sand lenses east of the facility are isolated from the lense located in the southeastern corner of the facility, located between the perched zone and the regional aquifer. Contamination has not been detected in wells east and southeast of well 12. Additional monitoring is required to determine whether remediation is warranted. Quarterly water level and water quality analyses of wells 12, 19, and 41 are proposed to aid in the assessment of the degree of interconnection between the two perched units and the potential rate of contaminant migration from the vicinity of well 12.

Comment 1.f: Condition 1.v.k of the April 6, 1990 closure and post-closure plan approval letter required, the following parameters required under 35 IAC Part 725 Subpart F to be monitored for both groundwater zones proposed to be monitored at the facility.

Groundwater Quality Parameters

Chlorine
Iron
Manganese
Phenols
Sodium
Sulfate

Drinking Water Parameters

Barium	Methoxychlor
Fluoride	Toxaphene
Mercury	2,4,D
Nitrate	2,4,5 TP Silvex
Selenium	Radium
Silver	Gross Alpha
Endrin	Gross Beta

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Selenium	Radium
Silver	Gross Alpha
Endrin	Gross Beta

Lindane	Turbidity
Coliform	Bacteria

The Agency's October 24, 1989 letter from Glenn Savage to Michelle Reznack, specified the groundwater monitoring program shall principally meet 35 IAC, Subtitle G, Part 724, Subpart F standards. The groundwater monitoring program as proposed does not principally meet these standards.

In response to Chemetco's comment the intermediate aquifer is used as a source of drinking water downgradient. The Hartford municipal wells are located northwest of Chemetco.

Chemetco must choose the groundwater monitoring parameters pursuant to 35 IAC Section 724.193. The parameters must include all the parameters detected in the zinc oxide and floor wash impoundments Appendix I sampling. Also, Chemetco must provide a more legible copy of the Appendix I sampling results.

Response: The ground water monitoring program has been revised to meet the requirements of 35 IAC 724. The ground water in the shallow perched unit will be monitored annually for the organic compounds detected in the zinc oxide and the floor wash water impoundment contents above the practical quantitation limit (PQL) in accordance with the December 2, 1988 IEPA letter from G. Savage to D. Hoff at Chemetco.

Comment 1.g: Condition 1.v.m of the April 6, 1990 closure and post-closure plan approval letter required additional monitoring wells would be necessary to the southeast of the SIDS system to monitor the effectiveness of the SIDS system. It also pointed out that borings may have to be done in this area to determine if the shallow sand lenses are present to monitor. Chemetco responded by stating additional wells were instaled; see Figure 3-1. However Chemetco has modified the shallow groundwater monitoring system that was previously approved. Specifically Chemetco has deleted monitoring wells C-6, 16, and C7-S located immediately downgradient of the SIDS system. Chemetco must provide for groundwater monitoring immediately downgradient of the SIDS system to monitor the effectiveness of the correction action.

Response: Wells C-6, 16, and C7-S were previously proposed as point of compliance wells. Two of these wells, C-6 and C7-S, were renumbered as wells 27 and 28, respectively. Wells 16, 27, and 28 are included in the monitoring program for the perched zone. Addition wells, 31A and 11, will be monitored independently of the point of compliance wells to evaluate the effectiveness of the SID system.

Comment 1.h: Condition 1.v.o of the April 6, 1990 closure and post-closure plan approval letter stated, use of the ANOVA test for the first year of monitoring is approved, however, if the calculated F statistic is significant, Chemetco must use the Average Replicate Test with individual well comparisons to determine which well statistically triggered. Adjustments for experiment wide error rates e.g. Bonferroni t-test, may not be used. Protection against unreasonable false positive error rates will be dealt with under resampling provisions.

For the first year, while eestablishing background, for the first quarter comparison the number of background samples shall be 8, for the second, 16, and so forth until the first years background is established.

After 1 year, when background has been completed, within 45 days after the 4th quarter sampling, Chemetco shall justify the use of the ANOVA test. The justification shall include a demonstration comparing the results of the ANOVA test to the results obtained by using only the Average Replicate Test with individual well comparisons. The results must show the ANOVA is equivalent to the Average Replicate Test using the individual well comparisons. If the demonstration shows the results are not equivalent then Chemetco shall propose an alternate statistical method which is appropriate for the distribution of the data and reasonably balances out the risks between Type I and Type II error rates.

If Chemetco chooses not to propose an alternate statistical method then the Average Replicate Test with individual well comparisons shall be required. This demonstration is due to the Agency at the same time as the fourth quarter monitoring results.

Chemetco responded by stating the closure plan was revised in accordance with the above comments. However Chemetco did not include the revised statistical procedure following the requirements how to use the ANOVA as specified above from the April 6, 1990 letter. This must be corrected.

Response: The ground water monitoring program outlined in Section 3 has been revised to include:

(1) the provision for using the Average Replicate Test with individual well comparisons in the event an alternative statistical method is not proposed; and

(2) the statement that Chemetco will report the results of the statistical demonstration with the fourth quarter monitoring results.

Comment 1.i: Condition 1.v.p of the April 6, 1990 closure and post-closure plan approval letter required that the full list of Appendix I constituents as specified in the regulations must be sampled for.

The Agency comment was in regard to 35 IAC 724, Appendix I analysis, not Appendix III. Chemetco must meet the rquirements outlined in Condition 1.v.p of the April 6, 1990 closure plan approval letter and listed above.

Response: As agreed, Chemetco will monitor for Appendix I parameters that were detected in the zinc oxide above the PQL in well 31A.

Comment 1.j: Conditions 1.v.q and 1.v.r of the April 6, 1990 closure and post-closure plan approval letter required (1) Chemetco to provide the existing data which indicates the Chemetco facility is at the center of a cone of depression and (2) Chemetco provide details of the groundwater control system for the intermediate aquifer. These details must address the comments given in the Agency's May 11, 1989 letter. Chemetco did not address the Agency's May 11, 1989 letter. The Agency cannot approve the monitoring plan until the details of the corrective action are submitted, along with the information requested in the Agency's May 11, 1989 letter. Also, Chemetco must include all the details available on the production wells (i.e. depth, pumping rate, etc.).

Response: On behalf of Chemetco, Inc., ENSR prepared a report entitled, "Hydrogeologic Summary" to provide a comprehensive account of the hydrogeologic and water quality data collected in the eight years of field investigations of the Chemetco facility. Sections 6 and 7 of the report describe the conceptual and quantitative models developed to assess the ground water control systems. Please see the referenced report for details of the gradient control system for the regional aquifer

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Comment 1.k: Chemetco has modified the intermediate monitoring system as required by Conditions 1.v.q, 1.v.t and 1.v.x of the April 6, 1990 closure and post-closure plan approval letter. However, Chemetco made changes by deleting previously approved monitoring well locations, without providing any justification for the changes. The proposed monitoring plan is inadequate to monitor the effectiveness of the corrective action and to determine the facility's impact upon the groundwater. The changes must be corrected as originally approved and any other changes required by this letter must be made before the Agency can determine if the monitoring plan is adequate or not.

Response: The groundwater monitoring program has been revised to address IEPA concerns. Please see the responses to comments 1.c and g above.

Comment 2.a A map was not provided showing the location of <u>all</u> wells listed in Table 3-1.

Response: A revised map of all the monitoring wells at the Chemetco facility has been included as Figure 3-1.

Comment 2.b. Groundwater flow maps were not provided to justify groundwater flow direction in the intermediate aquifer.

Response: A groundwater flow map has been provided in Section 4 of the "Hydrogeologic Summary."

Comment 2.c. The deep wells discussed in the January 1990 closure and post-closure plan were not addressed in the revised plan, even though Table 3-1 indicates four deep wells were installed. A detection monitoring program must be proposed for the deep aquifer.

Response: A detection monitoring program was proposed for the four wells screened in the lower zone of the regional aquifer. The four wells will be monitored quarterly for the ground water quality indicator parameters and waste constituents that provide a reliable indication of the presence of hazardous constituents in the ground water. Chemetco proposed to monitor for the constituents detected in the perched zone. These constituents, with the exception of copper, have not been detected in the upper zone of the regional aquifer at levels above those measured in the upgradient well. Since it is reasonable to assume that constituents would be detected in the upper zone of the regional aquifer before they would be detected in the lower zone the proposed monitoring program meets the requirements of 35 IAC 725.198.

Comment 2.d. None of the wells in the proposed monitoring plan are located in known or suspected contaminated areas. Monitoring in the areas is necessary to determine the regulated units impact on the groundwater and the effectiveness of the corrective action program.

Response: The wells in the monitoring plan have been revised to include 31A and to assess the effectiveness of the SID system. Additional wells were included to better define the hydrogeology and water quality of the sand lense east-southeast of the facility southeastern boundary.

Comment 2.e. Any existing analytical data from monitoring well 11 must be provided to justify this well is representative of background water quality.

Response: The water quality data collected from the wells at the Chemetco facility are presented in Section 5 of the "Hydrogeologic Summary"; all data are presented in Appendix C of the report.

Comment 2.f No qualitative data exists to date to confirm Chemetco's statement that the SIDS system effectively collects water flowing in the shallow aquifer away from the facility, preventing off-site migration of the constituents of concern. Groundwater flow maps prepared by the Agency using data from Chemetco's July 1990 closure and post-closure plan, Table 3-1, indicates the SIDS system is not effective for containing, controlling and capturing the groundwater in the shallow aquifer. Chemetco must address the Agency's findings and provide a detailed explanation with empirical proof, as to why Chemetco believes the SIDS system is effectively remediating the shallow aquifer. If Chemetco cannot make the above demonstration, a new remediation plan for the shallow aquifer shall be proposed in response to this denial.

Response: Please see the response to Comment 1.b., above, and Section 7.2 of the "Hydrogeologic Summary".

Comment 2.g. All groundwater monitoring sample collection and submittals must be in accordance with 35 IAC Part 745, Subpart F.

Response: The program was developed in accordance with 35 IAC Part 745, Subpart F requirements.

Comment 2.h. The theoretical model estimates described on page 3-5 were not proposed to be calibrated to the actual field measurements. For the conceptual flow model Chemetco intends to develop to demonstrate the effectiveness of the SIDS system, the Agency requires a copy of the model, a complete documentation for the model, identification of all model input parameters used and description of how this data was obtained. This information is needed in order to validate and verify the accuracy of the model, to evaluate the validity of the model assumptions and input parameters, and in order to evaluate the adequacy of the proposal. This information must be included in the response to this denial letter.

Response: Please see the response to comment 1.b., above, and Section 7.2 of the "Hydrogeologic Summary". The model to demonstrate the SID system is a conceptual model and not a quantitative flow model. The conceptual model is discussed in Section 7.2 of the Hydrogeologic Summary."

Comment 2.i. All metal analysis must be for totals as specified in the Agency's December 2, 1988 closure and post-closure plan approval letter.

Response: Appendix B of the closure and post-closure plan has been revised to indicate that all metals analyses will be performed for total metals.

Comment 2.j. The sampling and analysis plan in Appendix B must be revised to reflect all comments.

Response: The sampling and analysis plan in Appendix B was revised in accordance with the comments and the revised ground water monitoring program presented in Section 3.

1. INTRODUCTION

1.1 Purpose

This document presents revised closure and post-closure plans, as required, for five historical units at Chemetco, Incorporated, Hartford, Illinois. The units which are being closed in accordance with the RCRA closure requirements are the:

- zinc oxide pile and bunker, the pile having been closed and replaced by the bunker in 1984 so that successful closure of the bunker will satisfy closure requirements for the former pile, also;

- zinc oxide lagoons, sometimes referred to as the "dirt pits";

- cooling water canal; and,

- floor wash water impoundment, also referred to as the "acid pits".

Chemetco is attempting clean closure of the bunker. Chemetco is considering several options of handling materials removed from the bunker including recycling at a location in the U.S. or shipment overseas. The final option chosen is dependent upon economic conditions and the receiving facility's ability to accept the material. Depending upon which method is chosen closure of the zinc oxide bunker may involve the installation and use of two slurry tanks and a filter press. Because their operation would be as a result of and integral to closure of the bunker, closure of them is being included in the sections of this plan addressing the bunker. Completion of those activities will constitute final closure of the bunker unit. Because this will be a closure by removal, no post-closure provisions are applicable.

Chemetco is not attempting clean closure of the other three units. The cooling water canal, zinc oxide lagoons and floor wash water impoundment will be closed in place without removal of contents or residual material, if any. Final closure of these units is anticipated upon final plant closing.

In addition to the technical details of closure and post-closure care, this submission provides closure and post-closure cost estimates and a schedule under which Chemetco proposes to conduct closure activities. This plan has been developed in accordance with Illinois EPA's "Instructions for the Preparation of Closure Plans for Interim Status RCRA Hazardous Waste Facilities" (February, 1988).

The Chemetco facility was built in 1969 and initiated production of anode copper, cathode copper, crude lead-tin solder, zinc oxide and slag in 1970. All units being closed in accordance with this closure/post-closure plan, with the exception of the floor wash water impoundment and the cooling canal, are associated with the historical management of zinc oxide. However, it is IEPA's opinion that practices such as using lagoons and piles for zinc oxide production constitute land application and thus require RCRA closure. When E.P. Toxicity tested, the zinc oxide demonstrates greater than threshold levels of lead and cadmium. The material is not a listed waste but is hazardous for these characteristics only.

This document is intended to fulfill the applicable regulatory requirements for hazardous waste pile and impoundment closure/post-closure as set forth in 35 Ill. Adm. Code, Subtitle G, Parts 725 and 724. In addition, the document describes present and proposed groundwater monitoring activities related to closure of the facility as well as the on-site groundwater subsurface interceptor drainage system (SIDS) and groundwater pumping program.

1.2 Scope

This effort constitutes final closure of the Chemetco facility. The closure and post-closure plans address the five hazardous waste storage units located in four distinct waste management areas. In accordance with discussions between Chemetco and Illinois EPA personnel, this plan anticipates successful closure by removal or "clean closure" for the bunker (and former pile). Materials were previously removed from the lagoons and cooling water canal, however, IEPA considers verification testing previously completed to confirm the adequacy of those efforts to be insufficient. Further sampling efforts to demonstrate clean closure of these two units will not be pursued at this time, and they will be closed by capping all materials in place upon final plant closing.

The fourth unit, the floor wash water impoundment, has been associated with groundwater contamination and as such, is subject to closure requirements equivalent to those for an interim status landfill. As part of recent activities Chemetco has undertaken an extensive information review to delineate the lateral extent of the unit. Based upon this historical information, extent of the unit has been determined and a cap designed. After plant closure, the cap will be constructed over the former impoundment.

The post-closure plans include the appropriate inspection, maintenance, and monitoring procedures associated with the closure of the zinc oxide lagoons, cooling water canals and floor wash water impoundment as landfills. Chemetco will also continue to voluntarily operate groundwater control measures during the closure and post-closure periods, and conduct monitoring to evaluate system performance. The groundwater monitoring and control program, to the extent that the latter is shown to be necessary by continued monitoring, will be maintained throughout the necessary closure and post-closure periods in compliance with the regulatory requirements in 35 Ill. Adm. Code, Subtitle G, part 724. Details of the groundwater monitoring and control programs are found in Section 3. Through a series of discussions, Chemetco has agreed with the Agency to monitor both the upper and intermediate aquifer zones as part of closure.

1.3 Regulatory Considerations

Under interim status, the storage lagoons and piles must be closed in accordance with applicable Part 724 and 725 regulatory requirements. At closure, Chemetco proposes to remove standing liquids, hazardous waste and waste residues, and associated characteristically hazardous soil from the zinc oxide bunker in conformance with 35 Ill. Adm. Code, Subtitle G, Part 725, Section 725.358. Chemetco previously removed liquids, waste and residues, and characteristically hazardous soil from the zinc oxide lagoons, cooling water canal and zinc oxide pile. Confirmatory sampling and analyses will be conducted at the bunker under this closure plan to assure that the earlier work was sufficient to conform with Section 725.358. No additional sampling is anticipated for the lagoons and canal.

Due to the believed release of hazardous waste constituents from the floor wash water impoundment to groundwater a strict clean closure can not be effected for that unit at this time. As a result of the release of hazardous waste constituents, closure of the floor wash water impoundment must be in conformance with Section 724.410 landfill requirements, including emplacement of a cap and post-closure groundwater monitoring.

Source removal and confirmatory sampling efforts were completed in 1984 and 1985 for the lagoons and canal. Since the completion of those efforts, however, IEPA has established a soil cleanup standard which is less than the cleanup thresholds used by Chemetco in completing its cleanup efforts. As a result of IEPA's assignment of a lower cleanup standard based upon neither background nor health risk-based information, Chemetco is not at this time pursuing clean closure. Rather, closure of the lagoons and canal must conform with the landfill closure requirements of Sections 724.410. However, the lagoon and canal closures differ significantly from a standard landfill closure in that:

- All characteristically hazardous waste materials and contaminated soil from impoundment operation (the equivalents of a landfill's contents) were removed and placed in the secure bunker; and,

- Chemetco has designed, voluntarily installed, and operated groundwater control measures to preclude off-site migration of groundwaters.

By conducting these two activities, one to address potential releases of contaminant sources, and the other to preclude potential groundwater contamination, Chemetco is combining the most important and relevant features of closure by removal and closure as a disposal unit.

On March 19, 1987 USEPA proposed a "hybrid" closure approach that combines the strategies of closure by removal and closure as a disposal unit (see 52 Federal Register 8712). Depending on circumstances, this strategy may be equally or more effective than either the pure disposal or removal options. For example, rather than designing all caps to meet universal performance criteria to minimize infiltration and by leaving the waste in place, the hybrid approach consists of removing the majority of contaminated material and allowing covers and post-closure monitoring to be designed to site-specific standards based on the exposure pathways of concern, in Chemetco's case, groundwater and direct contact. For units with existing groundwater contamination above Agency-approved levels, USEPA is considering four options in the proposed amendment: 1) ineligibility for the closure alternative, 2) eligibility for the closure alternative only if groundwater remediation is undertaken during the closure period, 3) eligibility for the closure alternative without immediately addressing groundwater contamination under the provision that the facility could not be allowed to certify final facility closure until all groundwater contamination had been addressed, and 4) eligibility for the closure alternative as long as corrective action was implemented during the post-closure care period.

Chemetco's removal of lagoon and canal contents and associated characteristically hazardous soils, combined with the emplacement over each impoundment of a low permeability cap, meet the regulatory requirements of Section 724.410. In addition, groundwater monitoring and control efforts complying with Part 724 groundwater monitoring requirements will be conducted during the closure period. This type of closure is similar in design to closures currently underway in Illinois, other USEPA regions and at various CERCLA sites nationwide, and is one envisioned by the March 19 proposed amendment. Regulatory support for this approach to closure is found at 35 Ill. Adm. Code, Subtitle G, Part 724, Sections 724.217(d) and 724.218 (see Section 724.328).

1.4 Statement of Facility Status After Closure

Chemetco is pursuing final closure at this time. In addition to the surface impoundments and piles, the facility may install and operate under interim status two slurry tanks and an associated filter press to be used in the closure of the zinc oxide bunker. Upon completion of the bunker closure activities, Chemetco will discontinue use of the tank and filter press for managing hazardous waste and will conduct clean closure of the units. Cap emplacement over the impoundments will be completed upon shutdown of the plant. This action will constitute final closure of the facility. Chemetco will then no longer generate, transport, treat or store hazardous waste at its Hartford location.

2. FACILITY DESCRIPTION

2.1 General

The Chemetco facility is located within a primarily agricultural, light residential area south of Hartford and is bounded on the west by major, heavily traveled rail and highway routes and on the south by a limited use secondary road. More specifically, the 12 acre plant site is in the Southeast 1/4, Section 16, Township 4 North, Range 9 West of the Third Principal Meridian, in Madison County (see Figure 2-1). Chemetco's most recent Part A submission listed storage in a waste pile (S03) as the only waste management practice. However, a series of technical issues meetings and negotiations aimed at resolving long standing differences between IEPA and Chemetco as to the regulatory status of various materials management units were held in late 1987 and early 1988. These negotiations resulted in an agreement in principle on the regulatory status of all units in question. As a result, a modified Part A application which embodies that agreement was prepared and submitted with the October 1988 closure plan. The revised part A lists the following waste management practices:

- storage in a waste pile, S03, includes the zinc oxide bunker and former zinc oxide pile;

- storage in a surface impoundment, S04, includes the floor wash water impoundment, zinc oxide lagoons and cooling water canal;

- treatment in a tank, T01, includes a new tank to be used in the removal of zinc oxide from, and the closure of, the zinc oxide bunker; and,

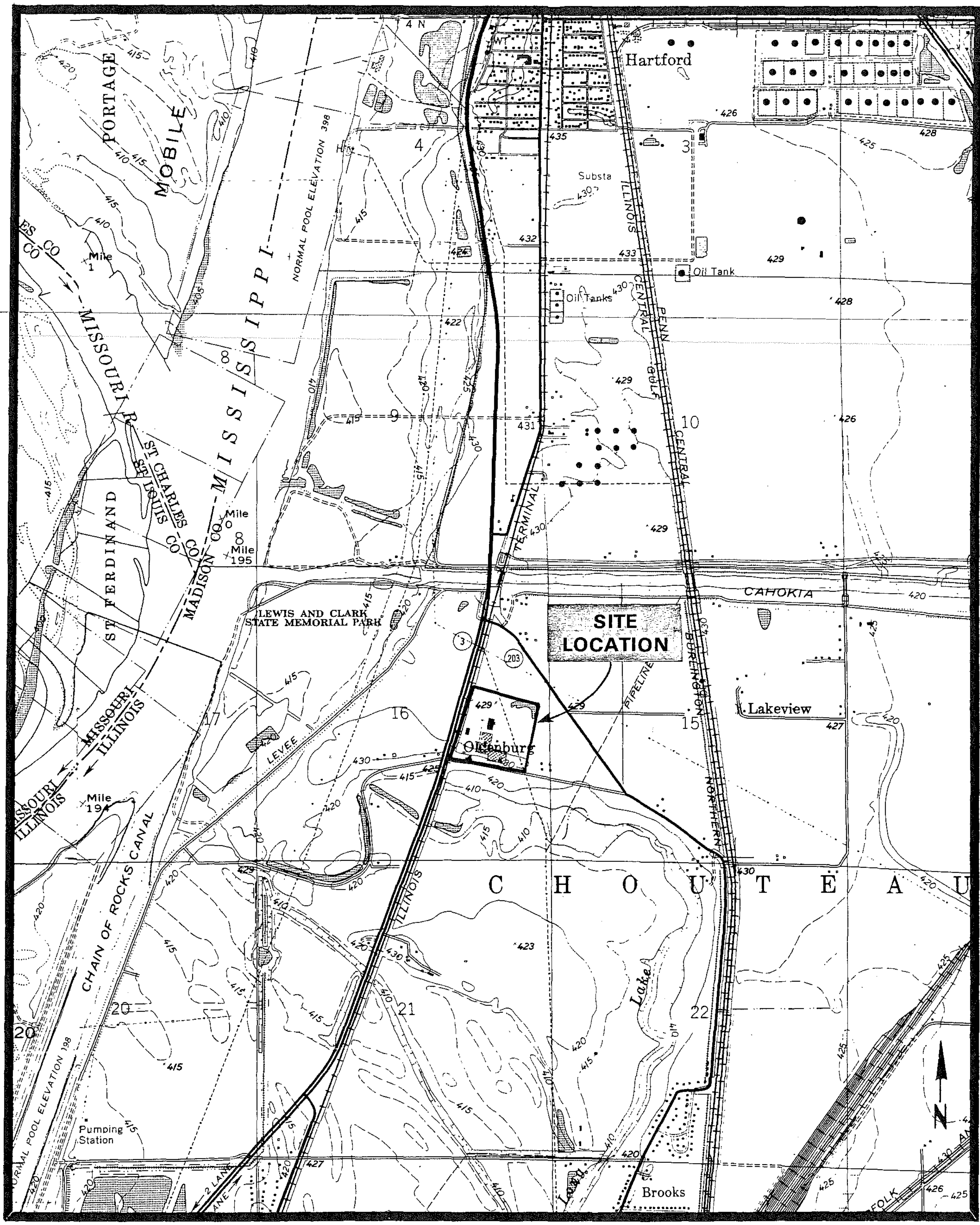

Figure 2-1 Site Location

- treatment in other, T04, includes a new filter press for dewatering zinc oxide from the bunker before shipment off-site.

2.2 Waste Management Units Being Closed

This section lists and describes the waste management units being closed:

- former zinc oxide pile and present zinc oxide bunker;
- zinc oxide lagoons, or "dirt pits";
- cooling water canal; and,
- floor wash water impoundment, or "acid pit".

The former zinc oxide pile occupied the present site of the zinc oxide bunker (see Unit 1 in Figure 2-2). The bunker was constructed after satisfactory removal of zinc oxide and soil contaminated from pile operations. These materials are now contained within the bunker. Based on sampling results Chemetco collected prior to bunker construction, and discussions with IEPA personnel, the former pile will be considered clean closed concurrent with the successful demonstration of clean closure of the bunker. The bunker and the remaining units, listed above and shown as Units 2 through 4 on Figure 2-2, are described in detail below.

2.2.1 Zinc Oxide Bunker

The zinc oxide bunker is listed on page 1, line 1 of the facility's revised Part A, Form 3. The unit, which is approximately 365 feet by 310 feet in dimension, has an estimated capacity of 3,000,000 gallons. The bunker was

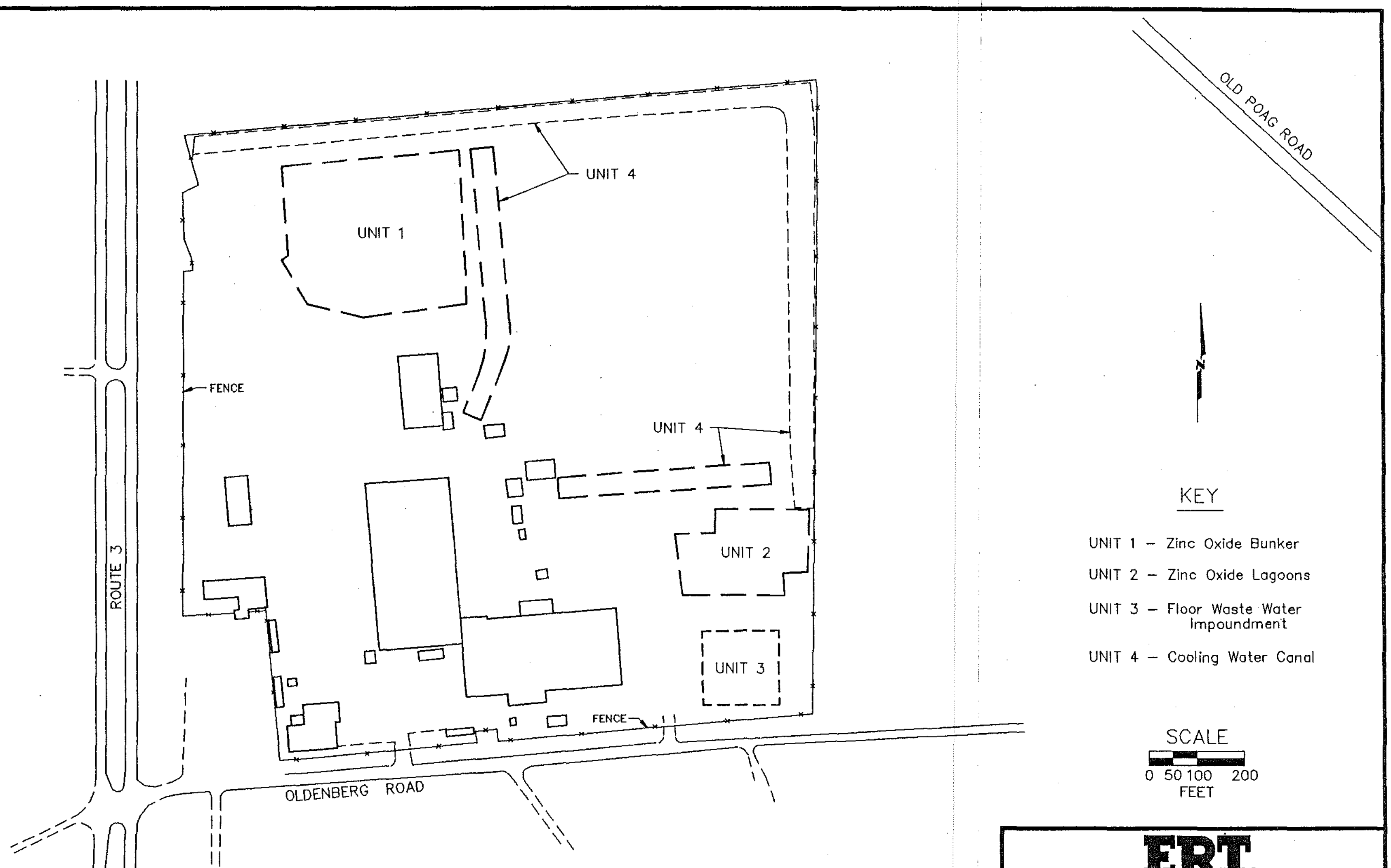

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FIGURE 2–2
FACILITY MAP
CHEMETCO

DRAWN BY:	DATE:	PROJECT NO.
KLU	5/88	1100–001–100

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constructed in phases in 1984 to replace an on-ground zinc oxide pile of approximate dimensions 150 feet by 200 feet. The former pile was located on the same site as the current bunker. The bunker contains primarily zinc oxide, with lesser amounts of soil excavated during the closure of the former pile, zinc oxide lagoons and cooling canal, and a small amount of slag used as a wind dispersal control measure on the north and west sides. Testing has shown the zinc oxide, which is being sold for reclamation of pure metals, to be Extraction Procedure Toxic for lead.

2.2.2 Zinc Oxide Lagoons

The zinc oxide lagoons are listed on page 1, line 2 of the facility's revised Part A. The two lagoons, which together as one unit encompassed an area approximately 150 feet by 220 feet and were 15 feet deep, had an estimated total capacity of 890,000 gallons. Constructed in 1978, the unit was operated until 1984 to gravity separate and dewater zinc oxide prior to sale and shipment off-site as a product. To the best of Chemetco's knowledge the unit received only production zinc oxide during its operating life.

2.2.3 Cooling Water Canal

The cooling water canal is listed on page 1, line 3 of the facility's revised Part A application. The canal, which was approximately 30 feet wide by 3600 feet long by 10 feet deep, had an estimated total capacity of 3,825,000 gallons. Exact construction date of the canal, which served as a source of non-contact cooling water for various plant equipment, is unknown. The canal was used until it was replaced with a cooling tower and closure began in 1985. The canal became subject to RCRA regulation only by virtue of a small (i.e., estimated at less than 2500 pounds) spill of zinc oxide from the zinc oxide lagoons into the south leg of the canal.

2.2.4 Floor Wash Water Impoundment

The floor wash water impoundment is listed on page 1, line 4 of the facility's revised Part A, Form 3. Many historical details of the unit, including exact construction date, capacity, and the date on which operation ceased are unknown. From conversations with older plant personnel and review of aerial photographs, a capacity of 50,000 gallons is estimated. It is believed that operations ceased in 1981. Previously Chemetco electrolitically refined its 99 percent pure anode copper to produce 99.9 percent pure copper cathodes. Sulfuric acid was the chief chemical used in the process, spills, drips and rinses of which were flushed out of the tank house into the unlined slag/earthen basin. Minor amounts of hydrochloric and hydrobromic acids were also present in the floor washings.

2.3 Interim Status Units To Be Closed

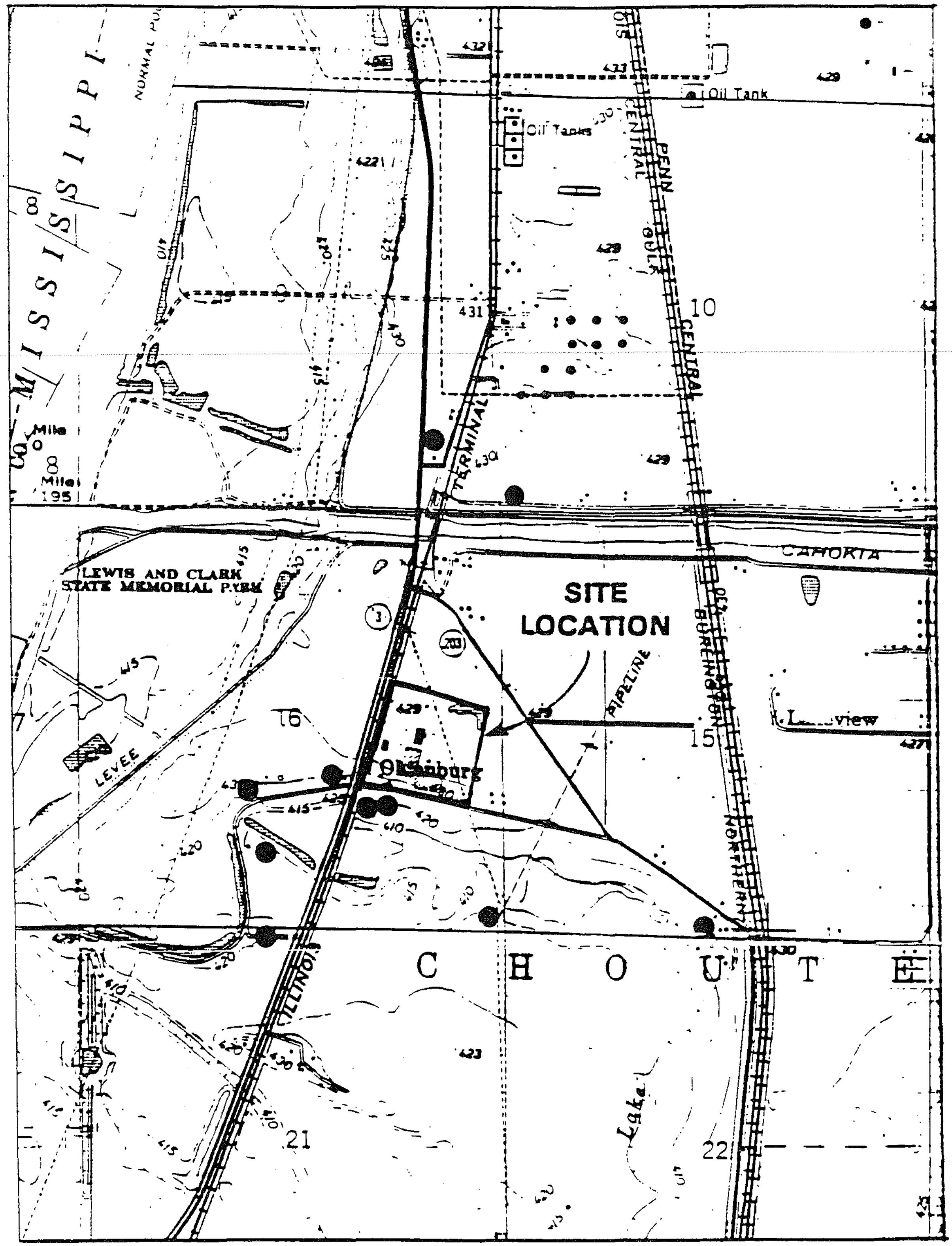
In addition to the four "unit areas" being closed in accordance with this closure plan, two new units may be used to facilitate the closure of the zinc oxide bunker. Closure of these units will proceed upon completion of zinc oxide removal activities from the bunker.

The two new treatment tanks and filter press are listed on page 1, lines 5 and 6, respectively, of the facility's revised Part A. The tanks will each be 2000 gallons in size and the filter press has a rated capacity of 40,000 pounds per day. Each is being installed adjacent to the zinc oxide bunker and will be used to facilitate bunker closure.

2.4 Groundwater Users Within One Mile

The Chemetco facility is located in a sparsely populated area. Consequently the number of withdrawal wells within one mile of the site is low. There are no recorded public wells within a one-mile radius of the site. The only commercial/ industrial well is Chemetco's own well (Permit No. 96094). This well water is not used for human consumption.

There are 10 private wells within one mile of the Chemetco facility. Figure 2-3 indicates the well locations in relation to the site. Several of the wells indicated in the Figure are believed to be no longer used. Through field investigations to be conducted concurrent with other field sampling activities, Chemetco will verify which wells are still in service in the area.



LEGEND

● PRIVATE WELL LOCATIONS

Figure 2-3

Private Well Locations within One Mile of the Facility

3. GROUNDWATER MONITORING AND CONTROL

The groundwater monitoring program was developed based on the site specific hydrogeology and water quality information gathered over the course of eight years of field investigations. The field investigations and their results are reported in a separate document entitled, "Hydrogeologic Summary, Chemetco, Inc., Hartford, Illinois". The program is designed to meet Federal (40 CFR 264.190) and Illinois (35 IAC, Subtitle G, Part 724, Subpart F) requirements in accordance with the Chemetco and IEPA closure negotiations. The program is described below following a brief introduction to the site hydrogeology. The program developed for the shallow perched water bearing unit that underlies the southeastern quadrant of the Chemetco site is presented first, followed by the program developed for the regional aquifer.

3.1 Site Hydrogeology

Several monitoring wells have been installed and investigations performed in an effort to characterize the site hydrogeology. Figure 3-1 shows the locations of the monitoring wells that have been installed at the Chemetco facility; Table 3-1 lists the wells installed and the construction specifications of each. Several of the wells installed early in the investigative process were renumbered; the former well designations are noted in parentheses after each well number. The site hydrogeology, based on recent investigations and knowledge of the regional hydrogeology, is summarized below.

The Chemetco facility is underlain by a clay and silty clay unit ranging from approximately 20 to 60 feet in thickness. Interbedded within the clay in the southeastern quadrant of the facility is a sand lense. The sand lense extends from 5 to 20 feet below grade with a maximum thickness of 15 feet and is bounded above and below by the clay and silty clay. The results

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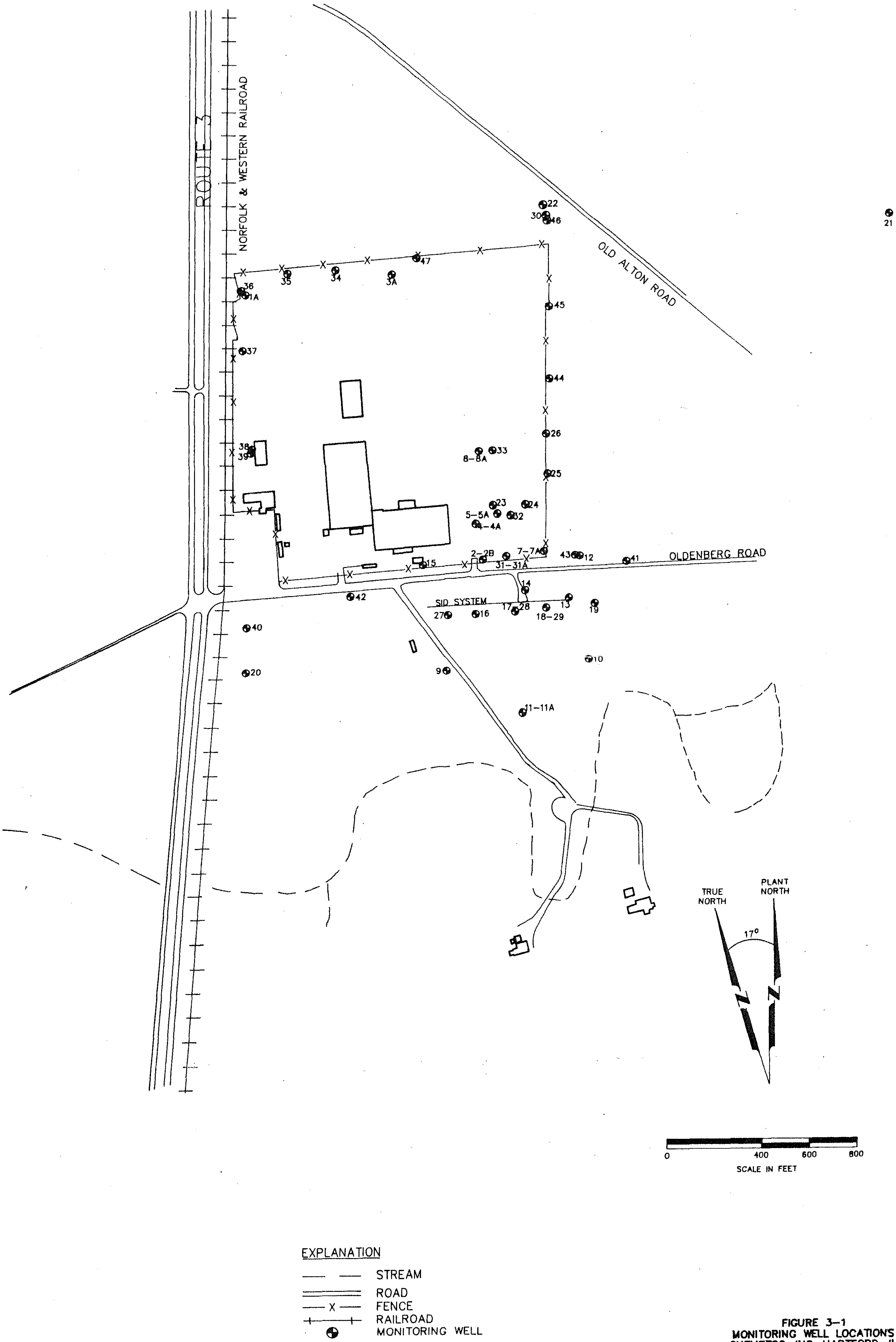

FIGURE 3-1
MONITORING WELL LOCATIONS
CHEMETCO, INC. HARTFORD, IL

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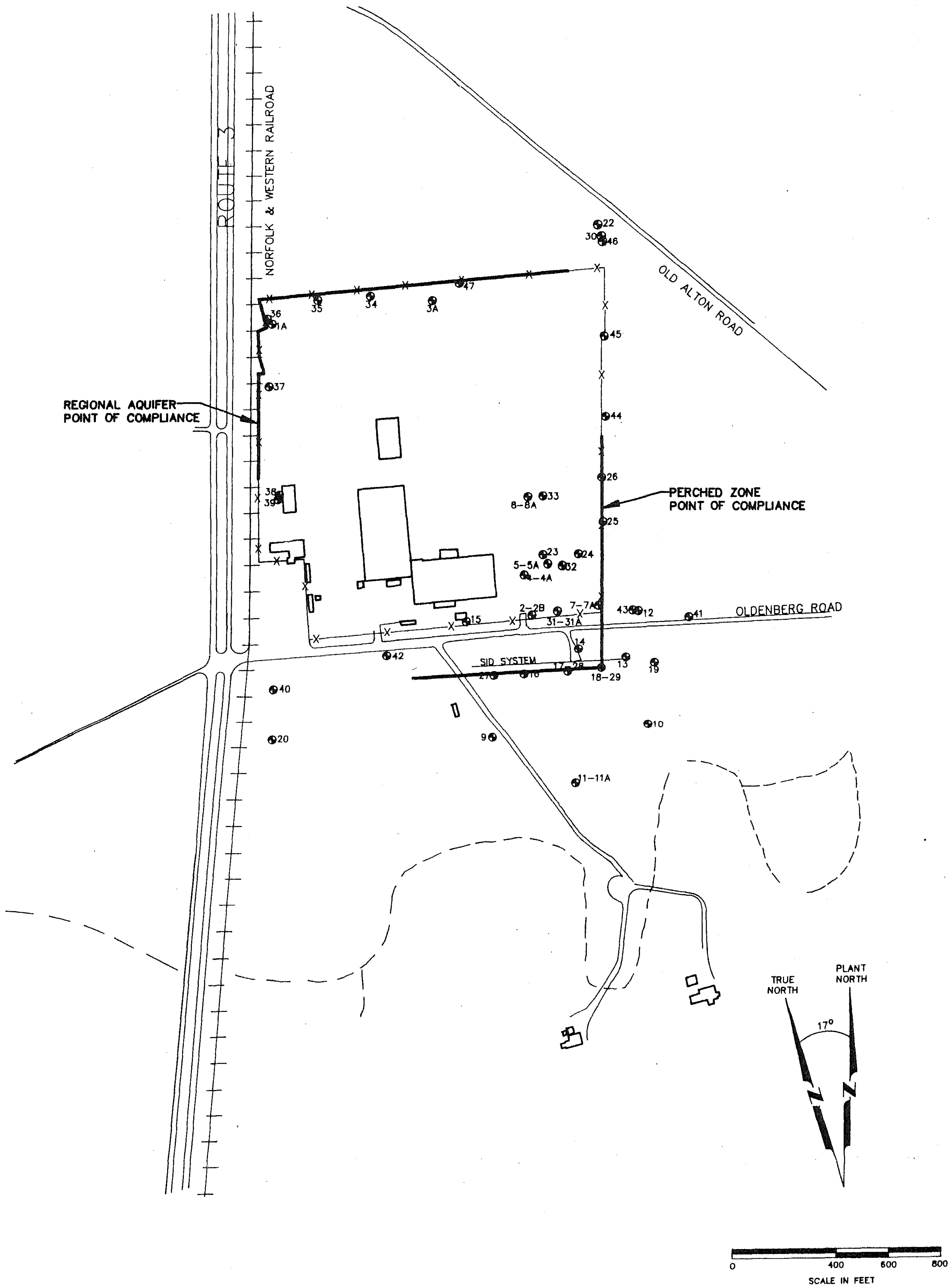

EXPLANATION

STREAM
ROAD
FENCE
RAILROAD
MONITORING WELL

FIGURE 3-2
POINT OF COMPLIANCE
CHEMETCO, INC. HARTFORD, IL

ENSR CONSULTING & ENGINEERING

TABLE 3-1

MONITORING WELL SPECIFICATIONS

Well No.	Approximate Ground Elevation	Top of Casing	Bottom of Screen	Top of Screen	Screen Length	Aquifer Type
1A	432.75	432.24	392.5	407.5	15	U
2	430.35	434.26	391.7	411.7	20	U
2B	430.05	434.72	414.1	422.6	8.5	P
3A	431.1	432.64	391.5	401.5	10	U
4	430.88	436.17	392.6	402.6	10	U
4A	431.5	436.07	416.2	425.2	9	P
5	431.75	437.61	394.8	409.8	15	U
5A	434.1	438.07	417.4	425.9	8.5	P
7	430.89	432.88	395.4	411.4	16	U
7A	431.55	432.91	415.2	425.2	10	P
8	433.3	436.29	394.1	403.7	9.6	U
8A	432.7	436.22	416.1	421.1	5	P
9	412.5	414.03	397.0	407.0	10	P
10	411.6	413.43	391.5	406.0	14.5	P
11	410.65	412.18	342.3	352.3	10	U
11A	410.9	412.02	395.4	400.4	5	P
12	428.6	428.92	408	418	10	P
13	419.3	420.85	394	404	10	U
14	421.0	422.89	412	417	5	P
15	430.5	430.92	411	421	10	P
16	418.7	419.41	409	414	5	P
17	419.0	418.80	404	414	10	P
18	418.85	419.02	394	404	10	U
19	418.25	418.62	404	409	5	U
20	417.5	418.89	370	380	10	C
21	428.0	430.58	398.6	408.6	10	P
22 (C1-S)	427.78	430.12	394.8	399.8	5	U
23 (C2-S)	433.24	436.66	412.2	417.2	5	P
24 (C3-S)	434.93	438.53	415.4	420.4	5	P
25 (C4-S)	428.08	431.40	405.6	411.6	5	P
26 (C5-S)	427.98	431.56	393.5	498.5	5	U

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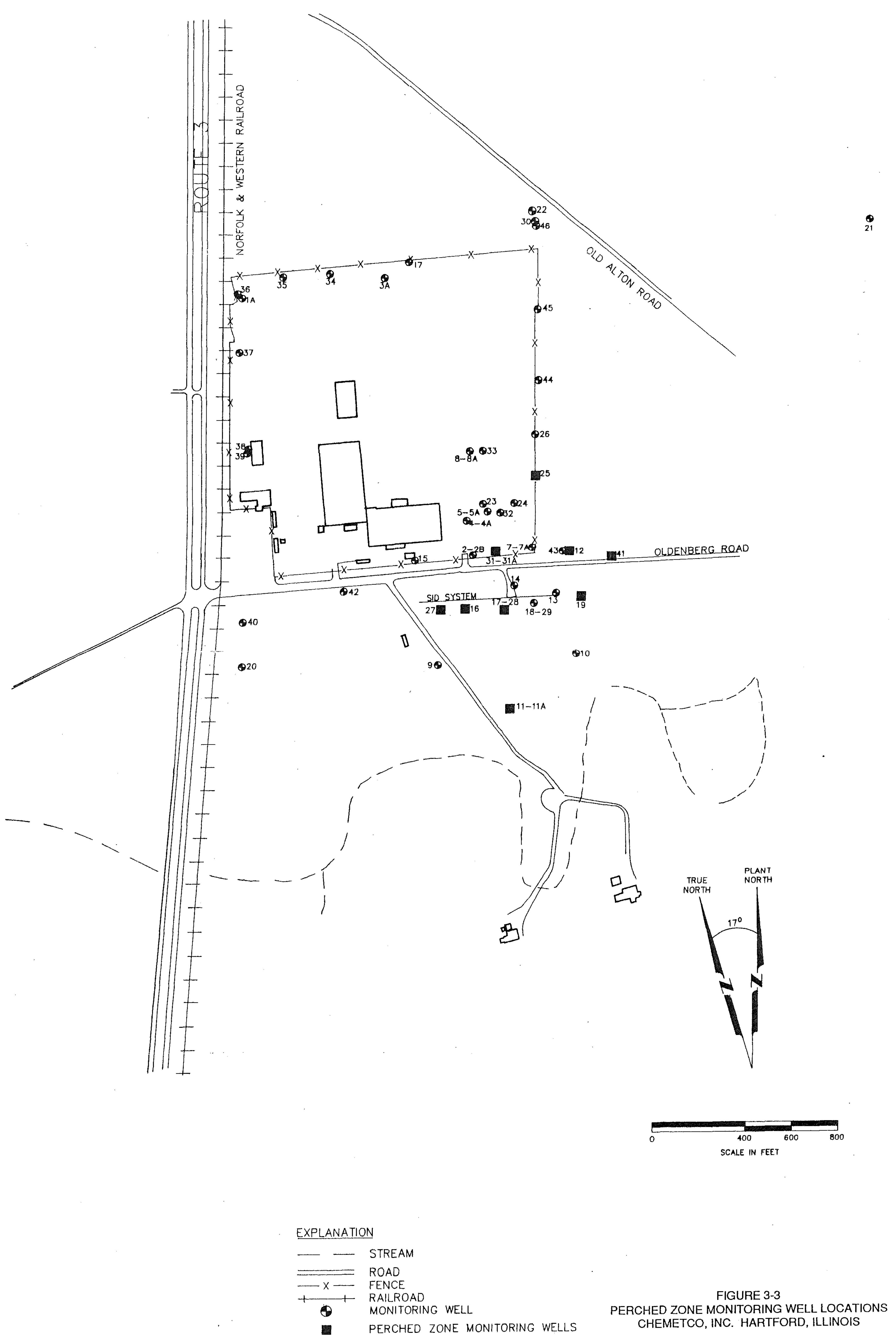

FIGURE 3-3
PERCHED ZONE MONITORING WELL LOCATIONS
CHEMETCO, INC. HARTFORD, ILLINOIS

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TABLE 3-1 (Cont'd)

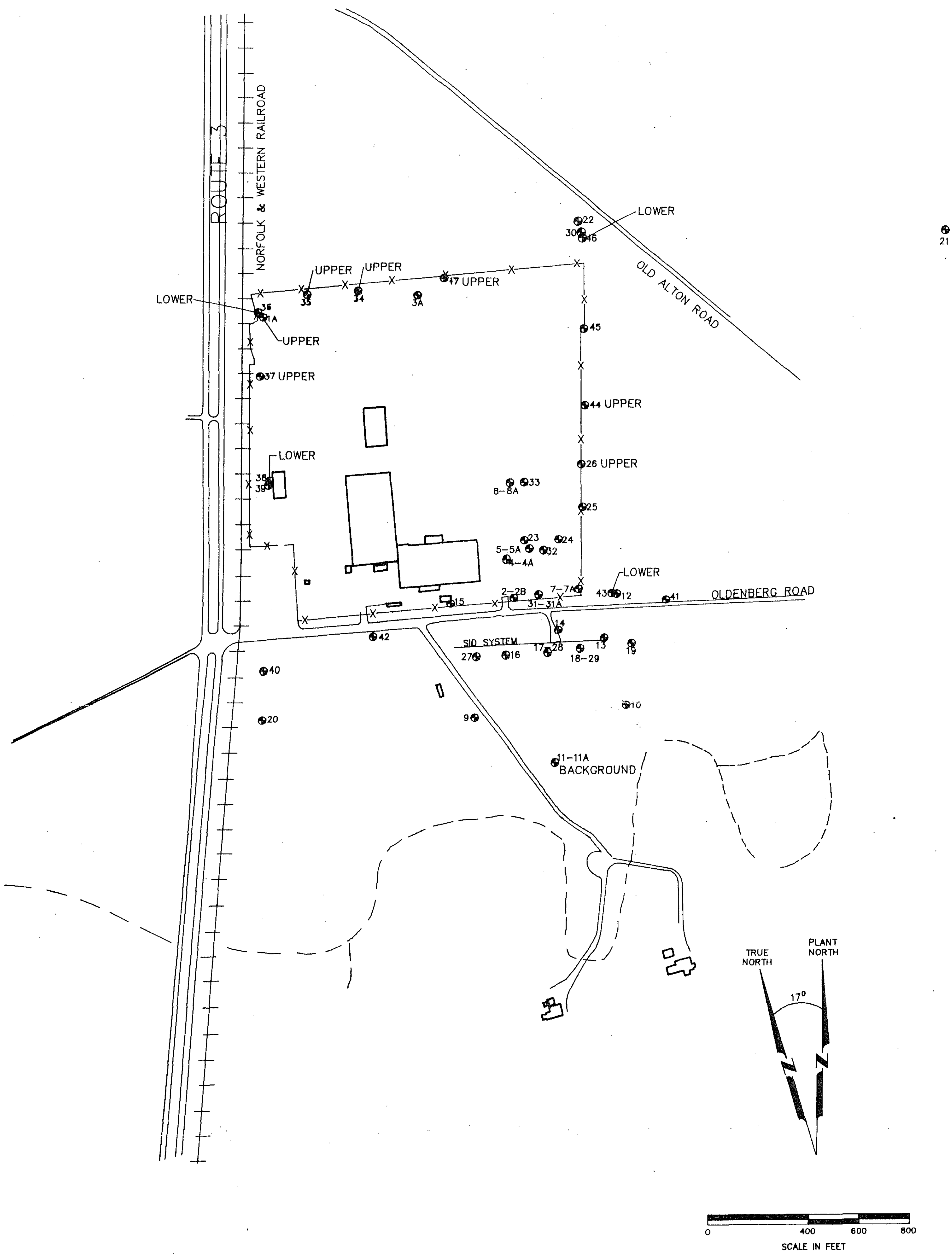
MONITORING WELL SPECIFICATIONS

Well No.	Approximate Ground Elevation	Top of Casing	Bottom of Screen	Top of Screen	Screen Length	Aquifer Type
27 (C6-S)	418.38	420.40	409.4	414.4	5	P
28 (C7-S)	418.38	421.17	403.4	408.4	5	P
29 (C8-S)	418.68	421.11	393.7	398.7	5	U
30 (ENSR-1)	428.21	430.11	410.2	420.2	10	C
31 (ENSR-2D)	433.10	435.34	398.1	403.1	5	U
31A (ENSR-2S)	433.06	435.60	418.1	423.1	5	P
32 (ENSR-3)	435.32	437.66	395.8	405.8	10	U
33 (ENSR-4)	433.84	435.86	394.3	404.3	10	U
34 (ENSR-5)	431.0	433.98	393.0	398.0	5	U
35 (ENSR-6)	432.1	435.08	392.6	402.6	10	U
36 (ENSR-7)	431.33	433.64	308.3	318.3	10	D
37 (ENSR-8)	429.89	432.85	*	*	10	U
38 (ENSR-9)	430.48	430.15	371.5	376.5	5	U
39 (ENSR-10)	430.40	430.15	313.4	323.4	10	D
40 (ENSR-11)	420.0	422.61	380.1	385.1	5	U
41 (ENSR-12)	422.5	425.35	402.5	407.5	5	U
42 (ENSR-13)	420.7	423.51	372.2	377.2	5	U
43 (ENSR-14)	428.5	431.12	313.0	323.0	10	D
44 (ENSR-15)	428.4	430.85	398.2	403.2	5	U
45 (ENSR-16)	428.1	430.86	390.1	395.1	5	U
46 (ENSR-17)	428.3	431.22	312.4	322.4	10	D
47 (ENSR-18)	430.3	432.98	386.3	391.3	5	U
Pump Well	430.51	433.11	380.5	395.5	15	U

Notes:
(1) all measurements in feet above mean sea level
(2) blank spaces indicate no data available

Aquifer Type:
P perched in the aquitard
C clay within the aquitard
U upper zone of the regional aquifer
D deep zone of the regional aquifer

* Data are not available



EXPLANATION

- STREAM
- ROAD
- FENCE
- RAILROAD
- MONITORING WELL

FIGURE 3-4
REGIONAL AQUIFER MONITORING
WELL LOCATIONS
CHEMETCO, INC. HARTFORD, IL

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of recent investigations indicate that the water flows from north to south across the southeastern quadrant of the facility. Data indicate the water-bearing formation does not extend to the facility northern and western boundaries and stops within 300 feet of the southern and eastern boundaries.

The clay layer averages 10 feet in thickness beneath the shallow perched zone and increases to 25 feet in thickness in the northern portions of the Chemetco facility (where the shallow perched zone is not present). The hydraulic conductivity of the clay layer was measured to be one to two orders of magnitude lower than the aquifers and therefore constitutes an aquitard. Hydraulic conductivity data are reported in the January 1991 "Hydrogeologic Summary".

Beneath the clay is a layer of fine to silty sand that grades to coarser sand with depth and finally to sand and gravel. This unit is a regional aquifer, the American Bottoms. The regional aquifer is generally greater than 90 feet thick and extends to the bedrock. Although there is no distinct boundary between the formations in the regional aquifer, the regional aquifer can be considered as being comprised of two distinct hydrogeologic units given the gradation from silty sand to coarse sand and gravel. Regional groundwater flows to the north and west in the area; water level data from monitoring wells at the site suggest groundwater flows north-northwest across the site. The regional aquifer is reportedly a drinking water source downgradient of Chemetco; Hartford municipal wells are reportedly northwest of the facility. The regional aquifer ultimately discharges to the Mississippi River.

3.2 Groundwater Control Measures

3.2.1 Perched Unit

As a result of the finding of groundwater contamination in the shallow perched zone, Chemetco initiated investigations into the extent of the contamination and feasibility studies of potential remediation measures. In early 1984 an acid recovery trench was installed south of the facility and contaminated groundwater recovered. Chemetco installed a subsurface interceptor drainage (SID) system in mid-1984.

The SID system is located just south of Oldenberg Road in the vicinity of monitoring wells 16, 17, 18, and 13. The system consists of two lengths of six inch diameter perforated PVC drainage pipe laterals which extend 235 feet east and 367 feet west from a buried stainless steel tank. The tank, acting as a temporary accumulation sump, is approximately six feet in diameter and twenty feet long and is buried vertically. The collector lines are seven to nine feet below grade at the ends, both of which are capped. The collector lines slope to permit gravity flow of captured water into the sump at a depth of about twelve feet. Approximately seven feet of sump remains below the point where the laterals are connected.

The lateral pipes were installed in a two foot side trench which was lined on the bottom and downgradient (south) with 20 mil impermeable pond liner. The pipes were wrapped in filter fabric and set on a bed of approximately nine inches of clean Meramac gravel and covered with about three feet of the same gravel. The gravel and piping were installed such that the top of the gravel pack lies at the base of the shallow perched zone. Therefore, the trench extends downward approximately three and one-half feet into the confining layer underlying the shallow perched zone. The trench was then backfilled with crushed silicate slag to within a few feet of the surface and finished with the excavated native material. The collector pipes (laterals) are equipped with exposed six inch diameter clean out pipes spaced at approximately 80 foot intervals.

Water flowing to the sump via the collector pipes is pumped back to the Chemetco facility by a surface mounted suction pump. The pump is automatically activated when the water level in the sump reaches 14 feet from the surface and shuts off when the level drops back to 17 feet. The level-activated pump ensures that the water level in the sump remains below the laterals, permitting full gravity drainage of the laterals to collect contaminated groundwater. The water pumped from the sump is discharged into the Polish Pits where the water is used in the production of zinc oxide.

The effectiveness of the SID system was evaluated using a conceptual model of the system operation, a water balance, and available water quality data. The results are reported in the 1991 "Hydrogeologic Summary". Specifically, the report presents the system's purpose (and design), provides a conceptual model of how the SID system operates, and reports on the system's effectiveness.

As described above, the SID system, installed as a passive system to collect all the groundwater flowing through the sand lenses, was constructed spanning the full width and depth of the sand lenses in the area. The SID system was not designed to nor is it recovering groundwater downgradient of the SID system. The SID system was installed in the sand lense outcropping; the sand lense which contains groundwater with elevated metals concentrations ceases immediately south of the recovery system.

The SID system was constructed at the downgradient end of the perched aquifer. The SID system intersects the sand lense outcropping. Therefore, the system effectively intercepts the groundwater containing elevated metals concentrations at the discharge area of the perched zone.

A water balance calculated based on the volume of water in the perched zone and recovered in the SID system indicates that the system is operating as designed. The volume of water withdrawn from the SID system correlates well with the volume of water flowing through the sand lenses.

The "Hydrogeologic Summary" also discusses the presence of a sand lense located east of well 12. Data indicate that well 12 may be in a transition zone between two sand lenses. Water levels are at a lower elevation in well 12 than the water levels measured in the sand lense where the SID system is located. Available water quality data, although minimal, indicate that concentrations of metals and water quality indicator parameters measured in samples collected east of well 12 are similar to the background well, 11A.

3.2.2 Regional Aquifer

In the course of closure negotiations, Chemetco agreed to control all offsite migration of groundwater. Water level measurements collected in 1989 show an incomplete cone of depression on the Chemetco site caused by the Chemetco production wells (see Figure 4-4 and Table 4-1 in the Hydrogeologic Report, June 1989). The wells appear to create groundwater flow toward the site from all directions; however, available data do not conclusively demonstrate that the northern boundary is presently within the cone of depression.

Chemetco designed a gradient control system which will prevent the offsite migration of groundwater in the upper portions of the regional aquifer. The wells will be located in the vicinity of the northwest corner of the property and screened within the upper 75 feet of the aquifer. The January 1991 "Hydrogeologic Summary" presents the gradient control system in detail.

Chemetco is prepared to initiate installation of the gradient control system wells, described in the "Hydrogeologic Summary", upon receiving closure plan approval. Once installed, pumping would commence from one well at a rate equivalent to facility water supply requirements. Additional pumping would not begin until the associated treatment system was completed and discharge permits were obtained.

3.3 Monitoring Program Objectives for Closure/Post-Closure

This groundwater monitoring plan addresses the Chemetco facility in accordance with the Chemetco and IEPA closure negotiations and the fact that several units will not be clean closed. The plan was developed to meet 40 CFR 264.90 and 35 IAC, Subtitle G, Part 724, Subpart F requirements outlined in the October 24, 1989 IEPA letter from G. Savage to M. Reznack at Chemetco. The facility point of compliance has been established as the facility boundary and the limits of known contamination on Chemetco property, shown in Figure 3-2. The groundwater monitoring program addresses the entire facility; however, due to the complex site-specific hydrogeology, separate plans were established for the shallow perched unit and the regional aquifer.

3.3.1 Perched Unit

Water level data indicate that water in the sand and silt lenses in the perched unit flows in a southerly direction. The point of compliance for the shallow perched zone parallels the SID system and the eastern facility boundary. Analytical data indicate that the water contains contaminants stemming from Chemetco processes. Water in the shallow unit contains elevated concentrations of lead, cadmium, zinc, arsenic, chromium, copper, and tin. In two rounds of Appendix IX analyses, no organics were detected at reportable concentrations. Based on analytical data and knowledge of Chemetco processes, the constituents of concern in the water in the perched unit are solely inorganics.

As described in Section 3.2, Chemetco implemented a passive recovery system, termed the subsurface interceptor drainage (SID) system, to intercept the contaminated water. The system is designed to intersect the entire column of water bearing sand and silt, thereby intercepting the contaminated water. The areal extent of the water bearing unit is limited to Chemetco property,therefore, there is no potential for offsite migration of the contaminated water. Since contamination has been detected in the shallow unit, the compliance monitoring program, described below, was designed to track the distribution of the contaminants and to measure the effectiveness of the SID system.

3.3.2 Regional Aquifer

Data collected on the regional aquifer indicate that groundwater naturally flows from the south-southeast to the north-northwest across the site, nearly opposite to the groundwater flow direction in the shallow perched zone. The point of compliance for the regional aquifer is the northern and northwestern property boundary. The IEPA stated that a full detection monitoring program must be conducted for both the upper and lower zones of the regional aquifer. The groundwater detection monitoring program presented herein was developed to detect statistically significant changes in water quality between groundwater upgradient and downgradient of the facility, consistent with IEPA requirements.

The gradient control system designed for the regional aquifer will reverse the natural groundwater flow direction; there will not be downgradient and upgradient wells. All wells will be hydraulically upgradient rather than downgradient of the facility. While the containment system is operating, the detection monitoring program will be evaluating the quality of groundwater flowing into the facility. Water level measurements will demonstrate the effectiveness of the containment system. Water quality monitoring will also provide data on the system's effectiveness.

3.4 Perched Unit Monitoring Plan

3.4.1 Well Locations

The locations of the wells to be monitored in the shallow perched zone are shown in Figure 3-3. Information on the well elevations and former designations is provided Table 3-1; Table 3-2 lists the wells incorporated in the shallow zone monitoring program, described below.

Point of Compliance

Wells were installed at the point of compliance near the southern and southeastern facility boundary and in a separate sand lense south of the facility boundary as shown in Figure 3-3. Point of compliance wells include wells 27, 28, 25, 16, and 12.

Wells 27, 16, and 28 are positioned immediately downgradient of the SID system. These wells are screened in the sand lense outcrop area. The wells are separated from the closed unit by the SID system trench and an impermeable pond liner. Although water samples collected from these wells have contained elevated metals concentrations, the metals present can be attributed to historic discharge of the contaminated groundwater at the sand lense outcrop area.

Well 25 is located adjacent to the facility eastern fenceline, approximately 600 feet north of the SID system. Well 25 is screened at approximately the same interval as the downgradient point of compliance wells. No elevated metal concentrations have been detected in well 25.

A fifth well, 12, is located east of the facility eastern fenceline. Well 12 was previously believed to be positioned in the same sand lense as the other point of compliance wells. However, as described in Section 3.2 and in the "Hydrogeologic Summary", well 12 is believed to be located in a transition zone

TABLE 3-2
GROUNDWATER MONITORING WELLS

SHALLOW PERCHED UNIT	
Background	11A
Point of Compliance	27 16 28 25 12
Subsurface Interceptor Drainage System	31A 28 11A
Southeastern Quadrant	12 19 41
REGIONAL AQUIFER	
Background	11
Upper Zone	
Point of Compliance	37 35 34 47 1A 26 44
Lower Zone	36 39 43 46

between the large sand lense intercepted by the SID system and another sand lense east of the facility.

Well 11A is also positioned in a different sand lense than the perched unit underlying the southeastern quandrant of the Chemetco facility. The well is located about 600 feet south of the facility fenceline. Well 11A was selected to provide information on background water quality.

As described above, the groundwater in several of the point of compliance wells presently contains elevated metals concentrations. The point of compliance wells will continue to be monitored in accordance with the requirements of 40 CFR 264.98 and 35 IAC 724.198. Data collected during point of compliance monitoring will also be used to evaluate the effectiveness of the SID system and the rate and extent of contaminant migration in the sand lense east of the southeastern facility boundary as described below.

Subsurface Interceptor Drainage System

The effectiveness of the SID system will continue to be assessed independently of the point of compliance. Chemetco proposes to monitor wells 31A, 28, and 11 to determine the rate of contaminant migration from the closed source areas.

Well 31A was installed immediately downgradient of the southernmost closed unit. Constructed of stainless steel, the well was intended to provide data on the potential leaching of organic compounds from the closed unit to the groundwater in the shallow perched zone. Well 31A will be monitored as an indicator of the water quality in closest proximity to the source area.

Well 28, also a point of compliance well, is located downgradient of the SID system. In conjunction with data collected from upgradient wells, water quality data collected at well 28 will aid in evaluation of the SID system's effectiveness.

Data collected from well 11-A, the background monitoring well, will also be evaluated to assess the effectiveness of the

SID system. Although positioned in a different sand lense, the well is downgradient of the other lense outcropping. If contaminated groundwater discharged from the perched zone migrates downgradient through surface soils, contamination would be detected in well 11-A.

The effectiveness of the SID system will also continue to be assessed based on the quality and volume of the water pumped from the system.

Southeastern Quadrant

The distribution of constituents of concern east of the southeastern facility boundary will be monitored using data collected in wells 12, 41, and 19. Well 12 is located in an area of known contamination; no elevated concentrations of constituents of concern have been detected to date in wells 41 and 19.

Water level data indicate that well 12 may be screened in a different sand lense than the lense that extends south of the facility fenceline; data indicate that clay separates the two water bearing strata. Based on hydrogeologic interpretation of available data, the contaminated water detected in well 12 is flowing south-southeast in a small local unit which may or may not extend southeast of well 12. Water level measurements of the wells screened in the aquitard have also shown that the sands screened in monitor wells located east of well 12. Wells 41 and 19, have water levels at elevations between the perched zone and the regional aquifer. This difference in water level elevations and the nonexistence of sand lenses between these two areas as shown by wells 13 and 18, indicate that the sand lenses to the east of Well 12 are isolated from the sand lenses located in the southeastern corner of the facility where groundwater contamination has been found. Monitoring the quality of wells 41 and 19 will aid in the assessment of the degree of interconnection between the two perched units and the potential rate of contaminant migration from the vicinity of well 12.

3.4.2 Analytical Parameters

Analytical parameters were selected for the shallow unit compliance monitoring program in accordance with the October 1989 closure plan approval letter and existing water quality information. The analytical parameters will provide the data necessary to (1) assess groundwater quality, and (2) ensure the effectiveness of the SID system in collecting contaminated groundwater.

The October 1989 closure plan approval letter requires that analytical parameters be selected consistent with a December 2, 1988 IEPA letter from L.W. Eastep to D. Hoff of Chemetco, Inc. The referenced letter requires: (1) the addition of lead and tin to the existing list of parameters, and (2) analysis of any Appendix IX parameter detected above the practical quantitation limit (PQL) in groundwater samples and the zinc oxide. The October 1989 letter also provides that the groundwater monitoring program principally meet 35 IAC, Subtitle G, Part 724, Subpart F standards.

Data indicate that the water in the shallow unit contains elevated concentrations of lead, cadmium, zinc, arsenic, chromium, copper, and tin. The shallow perched unit was sampled and analyzed for 40 CFR 264, Appendix IX parameters in May and October of 1989. The list of Appendix IX parameters (40 CFR 264) encompasses the list of Appendix VIII parameters (40 CFR 261) required by 40 CFR 264.99 and 35 IAC 264 Appendix I. None of the Appendix IX constituents were detected in the water in the shallow unit above PQLs specified for the U.S. EPA SW-846, Third Edition analytical methods for low level soil and sediment. The results of the Appendix IX analyses are provided in Appendix P.

Based on the October 1989 IEPA letter and existing water quality data, Chemetco will analyze the water in the shallow unit for the constituents of concern detected in the water samples and the zinc oxide. Specifically all wells in the monitoring program and the water collected in the SID system will be analyzed quarterly for the inorganic constituents of concern detected in the water in the shallow unit and inorganic water quality indicator parameters. Analytical parameters for the perched zone monitoring program are listed in Table 3-3.

Well 31A, formerly ENSR 2-S, will be monitored annually for the constituents detected in the zinc oxide, listed in Table 3-4. As described in Section 3.4.2, well 31A was constructed of stainless steel and installed directly downgradient of the floor wash water impoundment. The construction and location of well 31A make it the most suitable well from which to monitoring organic parameters that could potentially leach from the closed unit. If analyses indicate that organics may be leaching from the closed unit, Chemetco will submit a plan for a permit modification to establish additional monitoring.

3.4.3 Reporting

Chemetco will maintain records of the analyses performed on the water in the shallow unit for the life of the facility. Annually, and no later than March 1 following the subject calendar year, Chemetco will report the monitoring results to IEPA. If the program results indicate that the shallow perched unit no longer contains the constituents of concern, a detection program will be developed and submitted to IEPA for approval.

3.5 Regional Aquifer Monitoring Plan

3.5.1 Well Locations

Monitoring wells have been installed in both the upper and the lower zones of the regional aquifer to detect statistically significant differences in water quality potentially resulting

TABLE 3-3
ANALYTICAL PARAMETERS FOR PERCHED ZONE MONITORING

Constituents Detected in the Perched Unit

Lead
Cadmium
Zinc
Arsenic
Chromium
Copper
Tin

Inorganic Water Quality Indicator Parameters

pH
Specific Conductance

TABLE 3-4
ORGANIC COMPOUNDS TO BE MONITORED AT WELL 31A

(Compounds Detected in the Zinc Oxide and Floor Wash Water Impoundment Contents above Practical Quantitation Limits*)

Aldrin ?banned pesticides
Heptachlor
Delta-BHC

Methylene chloride
Acetone
Chloroform

Phenanthrene
Anthracene
Fluorene 3-4 ring
Fluoranthene
Pyrene
Bis(2-ethylhexyl)phthalate
Benzo(a)anthracene
Chrysene
Benzo(b)fluoranthene 5 ring
Benzo(k)fluoranthene
Benzo(a)pyrene
Dibenzo(a,h)anthracene
Dibenzo(a,j)acridine

* PQLs for low soil/sediment based on wet weight per U.S. EPA SW-846, Third Edition, Test Methods for Evaluating Solid Waste, Volume 1B: Laboratory Manual, Physical/Chemical Methods. November 1986.

from Chemetco operations. The monitoring well locations are shown in Figure 3-4.

Background

Chemetco selected well 11, located directly south of the facility's southeastern corner, as the upgradient well.

Upper Zone

The detection monitoring well network was installed to provide upgradient and downgradient indicators of groundwater quality in the upper zone of the regional aquifer. In response to IEPA concerns about well spacing, downgradient monitoring wells were installed at approximately 200-foot intervals along the facility's northwestern and northern fencelines. Wells 37, 1A, 35, 34, and 47 were selected to monitor the point of compliance. In response to additional IEPA concerns, wells were installed along the eastern fence line. Chemetco will monitor wells 26 and 44 along the eastern fence line to ensure that any potential groundwater contamination due to mounding beneath the former impoundments is detected before migrating offsite.

Lower Zone

Four wells were installed to monitor the lower zone of the regional aquifer. Wells 36, 39, 43, and 46 are located approximately at the four corners of the facility. Although no elevated metals have been detected in the facility water supply wells, located in the lower zone, in response to IEPA requests Chemetco will monitor the four wells screened in the lower zone of the regional aquifer.

3.5.2 Analytical Parameters

The analytical parameters for the regional aquifer monitoring program were selected based on the October 1989 IEPA closure plan approval letter and available hydrogeologic and water quality information as described in Section 3.4. As discussed in Section 3.4, the constituents of concern in Chemetco processes are limited to inorganics. The groundwater in the regional aquifer was sampled and analyzed for the Appendix IX constituents. No organics were detected in the groundwater in the regional aquifer above PQLs. In accordance with the IEPA October 1989 closure approval letter, well 31A in the perched zone will be monitored annually for the constituents detected in the zinc oxide. Monitoring the shallow perched unit for organics will provide the first indication that organic compounds may have leached from the closed unit. If analyses determine that organics potentially leached from the closed unit, then additional monitoring will be proposed and a request for closure plan modification submitted for IEPA approval.

The regional aquifer monitoring program, therefore, focuses on the constituents detected in the shallow aquifer or reasonably expected to indicate the presence of inorganic constituents. The upgradient and point of compliance wells will be analyzed quarterly for the indicator parameters and the waste constituents or reactions products that provide a reliable indication of the presence of hazardous constituents in the groundwater in accordance with 40 CFR 264.98 and 35 IAC 724.198. The indicator parameters and the inorganic constituents of concern identified in the regional aquifer are listed in Table 3-5.

Detection monitoring will be conducted quarterly in accordance with IEPA requests. For each monitoring round, four independent samples will be collected from each well. At least three well volumes will be purged to assure that the samples collected will be independent.

TABLE 3-5
ANALYTICAL PARAMETERS FOR THE REGIONAL AQUIFER

Constituents of Concern

- Lead
- Cadmium
- Zinc
- Arsenic
- Chromium
- Copper
- Tin

Inorganic Water Quality Indicator Parameters

- pH
- Specific Conductance

The analytical results obtained from the point of compliance wells will be compared against data obtained from the background well to determine whether there is a statistically significant increase in any parameter as a result of potential contaminant migration from the Chemetco facility.

3.5.3 Statistical Analyses

Chemetco intends to use a one-way parametric analysis of variance (ANOVA) as described in the Interim Final Guidance on Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (U.S. EPA PB89-151057). The Interim Final Guidance considers the ANOVA method to be the preferred statistical comparison method between compliance and background wells. The ANOVA will be performed quarterly in the first year, semi-annually in the following years for the contamination indicators, and annually in the following years for the water quality indicators. Statistical procedures will follow that described in Section 5.1 of the Interim Final Guidance. This section is included in Appendix F of this document.

For each of the sampled constituents, the ANOVA will test if the well means are statistically different. A sample data table for calculating the sample statistics in the ANOVA is provided (Figure 3.3). The statistical analysis will include a check to see that the residuals (defined as the difference between a measurement and the mean of all measurements at that well) are normally distributed. If the residuals are not normally distributed then the data will be log-transformed, the ANOVA will be repeated, and the resulting residuals will again be analyzed for normality. Given the nature of the contaminants and the site, it is unlikely that the residuals will not be normally distributed, and even less likely that the transformed data will not be normally distributed. However, if this occurs, then a non-parametric analysis of variance will be performed, according to the procedures described in the Interim Final Guidance.

In the event that the ANOVA shows a significant difference between the well mean concentrations, then additional pair-wise statistical tests will be performed. Contaminant concentrations at each compliance well will be compared with the background well (well 11) concentration using the Average Replicate Test, as described in Appendix B, Section 6 of the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD) (U.S. E.P.A. OSWER-9950.1), included in Appendix F.

Within 45 days of the first year, fourth quarter sampling, Chemetco will justify the use of the ANOVA. The analysis will compare the conclusions regarding average well concentrations made using either the ANOVA or the averaged replicate test performed with individual well comparisons. If the demonstration shows that the averaged replicate method detects contamination in situations where the ANOVA did not, then Chemetco will propose an appropriate alternate statistical method which reasonably balances out the probability of Type I and Type II errors, ,or use the Average Replicate Test with individual well comparisons. The statistical demonstrations will be reported with the quarterly monitoring results.

3.5.4 Reporting

Chemetco will report the compliance and the detection monitoring program results consistent with the requirements of 40 CFR 264.94 and 35 IAC 724.194. Data generated on background water quality will be reported to the Agency within 15 days of completing the quarterly analyses. Results of later monitoring will be submitted following each monitoring round.

Specifically, samples will be collected within one week and analyzed within one month following receipt. Chemetco will conduct the statistical determination of downgradient water quality and report the results to the Agency within 45 days of completion of sampling.

3.5.6 Procedures Following Detection of Contamination

As stated above, groundwater in the regional aquifer will flow toward the Chemetco facility from all directions. Therefore, it is not anticipated that statistically significant contamination resulting from Chemetco operations will be found in the detection monitoring wells. However, should contamination be detected, Chemetco will notify the IEPA in writing within seven days of making the determination. Chemetco must then submit an application for a permit modification to establish a compliance monitoring program under 40 CFR 264.199 and 35 IAC 724.199.

4. ZINC OXIDE BUNKER CLOSURE PLAN

4.1 Overview of Closure Approach

Under the closure and post-closure standards for waste piles, 40 CFR 265 Subpart L and 35 Ill. Adm. Code Subtitle G, Part 725 Subpart L, Chemetco intends to "clean close" the zinc oxide bunker/pile, with all waste residues and contaminated materials removed or decontaminated so that no post-closure monitoring will be required for this unit.

The former zinc oxide pile was decommissioned previously by Chemetco and the zinc oxide bunker created in its place. This closure plan summarizes the activities completed to date at the bunker/pile and details the closure to be implemented for the zinc oxide bunker.

4.2 Summary of Activities Completed to Date

The contents of the zinc oxide pile were removed and the area excavated at the point of decommissioning. As the area was excavated, soil samples were collected and analyzed for Extraction Procedure (E.P.) Toxicity for lead and cadmium. If samples tested E.P. Toxic, excavation was continued until analyses demonstrated the absence of contaminants.

The 150 foot by 200 foot zinc oxide pile was used to store and dry zinc oxide from the zinc oxide lagoons. Containment was provided by a low permeability berm and underlying clay that prevented runoff and infiltration, respectively. Closure of the pile began in early 1984 with removal of the stored material and excavation of the underlying soils. Zinc oxide material was moved from the north end of the storage area to the concreted areas to the west with both a crawler-loader and a rubber-tired front end loader. After all the zinc oxide was removed from the north end, the underlying soil was excavated until visibly clean. All excavated soil was placed with the zinc oxide material on the concrete surface to the west. A sampling grid was laid out at 50- by 75-foot intervals to provide samples for Extraction Procedure Toxicity testing for lead and cadmium. Excavation continued until satisfactory results were obtained. After achieving lead and cadmium levels below the detection limits of these analyses, the north section was covered by an 8-inch reinforced concrete slab and containment wall. The process of excavation, sampling, and concrete construction was repeated for the south section of the pile, as described in detail in the 1986 Closure Documentation Report. After the southern slab was poured and cured, the zinc oxide material and the excavated soil were moved by a rubber-tired front-end loader from temporary storage on the concrete west of the old site, to the new storage bunker. The southern walls were constructed, and a secondary containment system, consisting of a concrete curb and sump, was constructed around the perimeter of the bunker walls. The final analyses which document the clean closure of the former pile are summarized in Table 4-1 and attached as Appendix H. Results of Appendix IX analyses of the zinc oxide are also provided in Appendix H. Sampling locations are shown in Figure 4-1.

4.3 Waste Inventory

The zinc oxide bunker presently contains approximately 63,500 tons of zinc oxide and soils excavated from the former zinc oxide pile, the zinc oxide lagoons, and the cooling water canal during closure. No zinc oxide produced in daily plant operations is presently stored in the bunker. No material has been added to the zinc oxide bunker since the cooling water canal was closed in September 1985. Zinc oxide produced in Chemetco operations is containerized and shipped off-site daily in accordance with applicable regulations.

TABLE 4-1

SUMMARY EP TOXICITY TEST RESULTS

FORMER ZINC OXIDE PILE

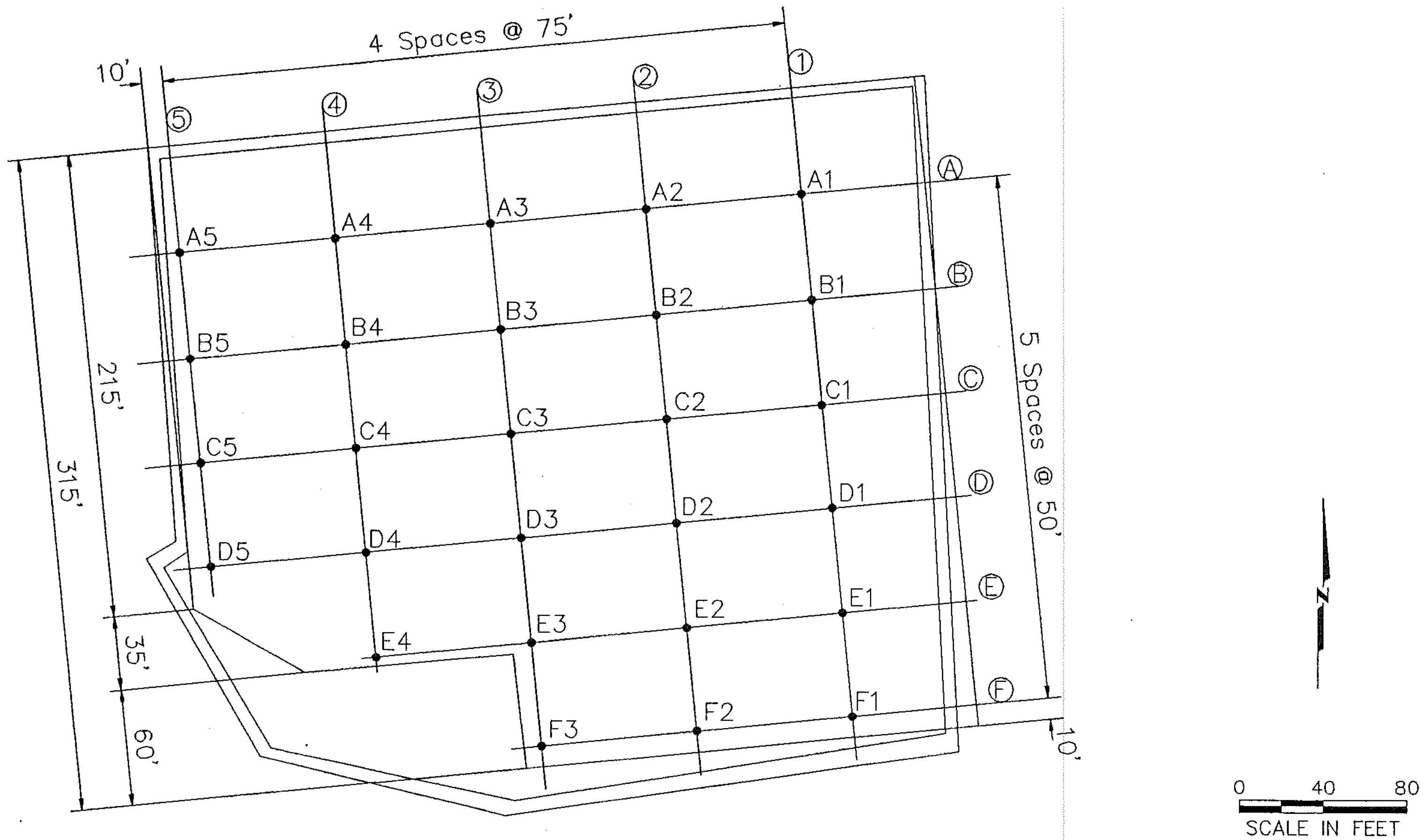
Sample No.	Lead mg/l	Cadmium mg/l	Lab
A1	BDL	BDL	ERT
A2	BDL	BDL	ERT
A3	BDL	BDL	ERT
A4	BDL	BDL	ERT
A5	BDL	BDL	ERT
B1	BDL	BDL	ERT
B2	BDL	BDL	ERT
B3	BDL	BDL	ERT
B4	BDL	BDL	ERT
B5	BDL	BDL	ERT
C1	BDL	BDL	ERT
C2	BDL	BDL	ERT
C3	BDL	BDL	ERT
C4	BDL	BDL	ERT
C5	BDL	BDL	ERT
D1	BDL	BDL	ERT
D2	BDL	BDL	ERT
D3	BDL	BDL	ERT
D4	BDL	BDL	ERT
D5	BDL	BDL	ERT
E1	BDL	BDL	ERT
E2	BDL	BDL	ERT
E3	BDL	BDL	ERT
E4	BDL	BDL	ERT
F1	BDL	BDL	ERT
F2	BDL	BDL	ERT
F3	BDL	BDL	ERT

Detection Limit: 0.05mg/l.

Analytical Method: SW 846 Method 6010

7008H 1100-001-100-100R

110011A



LEGEND

• Former Soil Sample

ENSR

ENSR CONSULTING & ENGINEERING

FIGURE 4–1
ZINC OXIDE BUNKER
FORMER SAMPLING GRID

DRAWN BY:	DATE:	PROJECT NO.
KLU	8/89	1100–001–100

4.4 Closure Procedure

The following subsections describe the procedures that will be followed in closing the zinc oxide bunker, formerly the zinc oxide pile area.

4.4.1 Removal of Zinc Oxide

Before removal of any materials from the unit, the adjacent concrete area will be prepared to facilitate the dewatering of any material as necessary for transportation. Preparation for the dewatering will consist of the engineering and set-up of screening apparatus, slurrying tanks, and filter presses as well as the associated pumps and piping that will allow for transfer of zinc oxide from the slurry tanks to the filter presses.

Necessary mobile equipment such as endloaders or a clamshell crane will be used to remove the dry surface material that does not require treatment before shipment. For material too wet to transport, two possible methods may be used to transfer material from the bunker to the slurrying tanks. The first method would involve the continued use of mobile equipment and/or a conveyor system to load the material directly into the slurry tanks. The second method would be to slurry the zinc oxide material directly in the bunker when sufficient area in the bunker allows and the zinc oxide is free of slag. The slag free material would be slurried with a facility water system, and transferred via pump (or other means) either directly to the filter press or into the slurrying tanks for later filtration.

Once in the tanks, the zinc oxide material will be mixed in equal proportions or as required to maintain a pumpable homogeneous slurry. The zinc oxide slurry will then be pumped to a filter press for dewatering to 30% moisture content. All process water will be recycled to the slurry tanks. As there will be a net water loss (approximately 30%), no water will require disposal until all zinc oxide is removed from the bunker. At that time, water samples will be collected and analyzed to determine the appropriate type of disposal. If the process water is not hazardous for lead or cadmium, the water will be used in the "AAF" scrubber system. If the water is hazardous, then sodium hydroxide will be added to precipitate the metals, the solids will be filtered out and added to material being shipped off-site for reclamation, and the water will be left in the bunker to evaporate.

When the filter press reaches capacity, the material will be transferred by conveyor or mobile equipment from the filter press to the shipping unit/container for transport to Zinc Nacionale in Monterrey, Mexico for metal reclamation. The material, labeled as D008 and D006 waste, will be manifested according to RCRA requirements and corresponding Illinois regulations and transported in compliance with applicable DOT regulations. An estimated 63,300 cubic yards of material will be removed from the bunker.

4.4.2 Removal of Slag

Because of the method used in filling the zinc oxide bunker and the use of slag as a wind-dispersal control agent, zinc oxide in the bunker is intermixed with slag. Neither the amount of slag present nor the degree of intermixing is known. In the initial effort of removing dried surface materials, much of the slag will be shipped to the Mexico metal reclamation facility with the zinc oxide material. Upon conclusion of that phase, any slag remaining with the zinc oxide will be separated by sight. Any large pieces that could damage pumps or screens will be removed by hand or heavy equipment before slurrying. Any smaller pieces that might damage the transfer pumps, will be screened and separated from the zinc oxide material destined for the filter press during the slurry process. The separated slag will be collected and stored in a separate designated area of the zinc oxide bunker until sufficient quantities are accumulated for shipment. Chemetco is arranging a contract with Zinc Nacionale for all materials in the bunker including the slag. As a precautionary measure the waste will be labeled D008 and D006 and will be manifested according to all RCRA requirements and corresponding Illinois regulations and transported in compliance with applicable DOT regulations.

4.4.3 Decontamination of Bunker

After the contents of the bunker and all visible contamination are removed, the entire bunker will be pressure washed. The wash water will be recycled to the slurry tanks in the same way as the process water. Samples will be collected and analyzed for total metals (lead and cadmium) content. If results indicate hazardous metal concentrations in the wash water, the metals will be precipitated out and the solids collected in the filter press. This will be repeated until the wash water tests non-hazardous. All accumulated solids will be shipped with the bunker materials to Zinc Nacionale. The water will be used in facility production operations.

4.4.4 Decontamination of Equipment

All mobile equipment will be dedicated to moving the material, as required, for the duration of the project. This also applies to any tanks, filter presses, pumps, screening apparatus, conveyors and hoses that are used in the dewatering procedure. At the end of this project all materials will be decontaminated before being used in other plant operations.

The first step will be to decontaminate any heavy mobile equipment that will no longer be needed. The equipment will be scraped and washed with high pressure water until visibly clean. All water will be disposed of as in the method described in the preceding section.

The rest of the equipment will be decontaminated in the same manner; all water will be treated as in Section 4.4.3.

4.4.5 Closure Activities for Zinc Oxide Slurry Tanks and Filter Press

According to the tank and physical treatment closure and post-closure standards of 40 CFR Part 265, Subparts J and Q, and 35 Ill. Adm. Code, Subtitle G, Part 725, Subparts J and Q, two approaches are available:

- "clean" closure, with all waste residues and contaminated materials removed or decontaminated (does not require post-closure monitoring); or,

- closure with some waste residues or contaminated materials left in place (requires post-closure monitoring).

Since the slurry tank and filter press will be installed and operated in compliance with all applicable interim requirements for a new tank and treatment system including full secondary containment and a leachate collection, detection and removal system, a clean closure approach is feasible under present U.S. and Illinois EPA policy and guidance.

4.4.5.1 Summary of Operation

The slurry tank and filter press will be located on a concrete pad to the north of the zinc-oxide bunker. Contents of the bunker will be transported to the slurry tank via a loader. The tank will be screened to separate the larger pieces of slag. Screen size will be dependent on the diameter of piping used to feed the filter press and any applicable specifications of the slurrying equipment and filter press.

Once in the tanks, the zinc oxide material will be mixed with water as required to maintain a pumpable homogeneous slurry. The zinc oxide slurry will then be pumped to the filter press for dewatering to 30% moisture content. All process water will be recycled to the slurry tanks. As there will be a net water loss (approximately 30%), no water will require disposal until all zinc oxide is removed from the bunker.

When the filter press reaches capacity, the material will be transferred by conveyor mobile equipment from the filter press to the shipping unit/container for transport to Zinc Nacionale in Monterrey, Mexico for metal reclamation. The material, labeled as D008 and D006 waste, will be manifested according to RCRA requirements and corresponding Illinois regulations and transported in compliance with applicable DOT regulations.

Any slag collected by the tank screen will also be shipped to Zinc Nacionale according to the same procedures.

Secondary containment will be provided by the cement pad already in place and a dike wall constructed also of cement around the tank and press. Prior to construction of the system, the cement pad will be inspected for uneveness, cracks or gaps. Any such weaknesses in the system will be repaired before installation of the tank and filter press. The area encompassed by the dike and the height of the dike will be sufficient to contain 100% of the slurry tank's capacity. Any joints in the cement will be seemed with chemically resistent water stops and the entire interior surface of the dike system will be sealed with an impermeable coating. Similarly any exterior joints in the dike will be blocked with water stops in order to prevent run-on into the system.

The entire secondary containment area will be sloped to a collection sump. The area and sump will be inspected at least daily for accumulated rain water or other liquids which will be pumped into the slurry tank/filter press system.

4.4.5.2 Closure Procedures

The slurry tank and filter press are hazardous waste management units installed and utilized for the closure of the zinc oxide bunker. Thus closure of these units will occur concurrent to closure of the bunker.

Since these units will be constructed new, contamination of the surrounding environment can occur only from leaks or spills in handling the waste. Any such releases will be quickly and easily identified during normal operation of these units. Thus clean closure will consist of removal of all waste from the system, and decontamination and disposal of the slurry tank and filter press.

This unit will operate in full compliance with the interim status standards. Further, all waste handling will occur within the secondary containment system. The possibility of the release of hazardous materials to the environment will be minimized to the maximum extent practical in the operation of this unit. Thus no soil sampling or groundwater monitoring is required to effect clean closure of this unit. Such sampling would be necessary only in the unlikely event of a release to the environment. In such an event, the unit's operation and closure, as well as the need for environmental sampling, would have to be reassessed.

Removal of Zinc Oxide Material

Removal of the waste inventory occurs as part of the normal operations of these units. Material will be removed from the filter press and transferred to railcar by conveyor or mobile equipment. Once the final load of material from the zinc oxide bunker has been processed through the filter press, the slurry tank will be visibly inspected to verify that it is empty of waste material. If it is not empty, remaining waste material will be removed either by continued slurrying or by draining the tank and removing any sludges by hand using scrapers and shovels. Any sludges will be processed through the filter press or packaged for addition to waste material being shipped to Zinc Nacionale.

After the final load of waste material is removed from the filter press, it will be visually inspected. Residues or sludges will be removed by hand using scrapers and shovels and added to the waste material being shipped to Zinc Nacionale.

Similarly, once all waste is removed from the system the entire secondary containment area will be visually inspected. Any visible contamination or residues will be removed by hand using scrappers and shovels and added to the waste shipment to Zinc Nacionale.

Process water will be drained from the system most likely at the point just prior to recycling into the slurry tank, collected and analyzed to determine the appropraite type of disposal. If the water is hazardous, then sodium hydroxide will be added to precipitate the metals, the solid will be filtered out and added to material being shipped off-site for reclamation, and the water will be left to evaporate.

<u>Decontamination of the Unit</u>

After all visible contamination is removed, the entire containment area, including the exteriors of the filter press, slurry tanks and associated equipment will be washed with high pressure spray. The water will be collected in the containment sump and tested for metals (lead and cadmium). If it is hazardous, the metals will be precipitated out in the slurry tanks using sodium hydroxide and the solids collected in the filter press. This will be repeated until the water tests nonhazardous. All accumulated solids will be shipped to Zinc Nacionale. The water will be used in facility production operations. If after repeated processing the water still tests hazardous, it will be placed in an on-site evaporator or containerized and shipped to an appropriate treatment facility.

1. Decontamination of the Slurry Tanks

The interior of the slurry tanks will be washed with a high pressure spray. The washwater will be collected and analyzed for lead and cadmium levels. If the washwater is hazardous, it will be treated with sodium hydroxide to precipitate the metals. The metals can then be filtered by processing through the filter press. The water will be used in facility production operations.

2. Decontamination of Piping

Ancillary piping will be dismantled and pressure washed at the collection sump. Piping will be visually inspected for contamination after cleaning. Any piping not passing visual inspection will be cleaned again. If repeated cleaning fails to remove visible contamination, the piping will be packaged for shipment to a RCRA Subtitle C treatment or disposal facility. Rinsate will be collected and tested for lead and cadmium. If the water is hazardous, the metals will be precipitated out and the solids collected in the filter press. If the filter press is inoperable, contaminated water may be placed in a portable evaporator to collect the metals or packaged and shipped to an appropriate treatment facility.

3. Decontamination of Filter Press

After the contents of the press and all visible contamination are removed, the press will be flushed and pressure washed. The wash water will be collected and analyzed for total metals (lead and cadmium) content. If results indicate hazardous metal concentrations in the wash water, the metals may be collected in a portable evaporator or the washwater will be containerized for shipment to an appropriate treatment facility. This procedure will be repeated until the wash water tests non-hazardous. All accumulated solids will be shipped with the waste materials to Zinc Nacionale.

4. Decontamination of Equipment

All mobile equipment will be dedicated to moving the material, as required, for the duration of the project. This also applies to any tanks, filter presses, pumps, screening apparatus, conveyors and hoses that are used in the dewatering procedure. At the end of this project all materials will be decontaminated before being used in other plant operations.

The first step will be to decontaminate any heavy mobile equipment that will no longer be needed. This will occur once all waste materials have been removed from the system. The equipment will be scraped and washed with high pressure water until visibly clean. All water will be deposited in the slurry tanks.

The rest of the equipment will be decontaminated in the same manner; all water will be treated as in Section 4.4.3.

4.4.5.3 Final Decontamination and Disposal

Once the slurry tanks and filter press have been decontaminated they can be dismantled and removed from the containment area. The slurry tanks and filter press may be reused on-site in facility production operations or will be sold for scrap or, in the case of the filter press, sold for reuse.

The entire containment area will be pressure washed again. The rinsate will be collected and tested for lead and cadmium. If it is hazardous, the water will be placed in the on-site evaporator or shipped to an appropriate treatment facility. Washing will be repeated until the rinsate tests nonhazardous.

Upon final closure, the concrete pad and dike will be left in place.

4.4.6 Post-Closure Provisions for the Bunker

In closure, all hazardous wastes and contaminated materials will be removed from the bunker and disposed of properly. The cement structure will be decontaminated and remain in place. Since no hazardous materials will be left at this unit no post-closure monitoring or maintenance is necessary. The integrity of structures left in place will be assessed at closure to verify that they pose no physical hazards. Since this unit will not be demolished, future use of the bunker is limited only by the limits of the structure itself.

4.5 Confirmatory Soil Sampling and Analysis Plan

4.5.1 Previous Soil Sampling Activities and Establishment of Cleanup Standards

The zinc oxide bunker was constructed in 1984 upon decommissioning and confirmatory testing which indicated successful removal of materials from the former zinc oxide pile. The location of the floor of the bunker is such that it completely covers the area where the former pile was placed. The previous sampling and analysis demonstrated the "clean" closure feasibility before the reinforced concrete pad and containment berm were poured. Results of this sampling are presented in Table 4-1, and attached as Appendix H. These samples were collected in a grid beneath the existing bunker at locations shown in Figure 4-1. Subsequent to this sampling the Agency established the following clean-up standards for soils at the Chemetco facility:

Lead: 0.05 mg/l (EP toxicity)

Cadmium: 0.01 mg/l (EP toxicity)

The sampling conducted for the bunker had a detection limit of 0.05 mg/l for both lead and cadmium. Thus the detection limit is equal to the clean-up standard established for cadmium.

In negotiations with Chemetco, the Agency has accepted the previous sample data for lead and confirmed that the unit is considered "clean" as far as lead contamination is concerned. However, Chemetco must verify that lead and cadmium levels around the unit are not above the cleanup objectives. Thus, following removal of the bunker's contents and decontamination, perimeter soil samples will be collected as described in Section 4.5.2 below and analyzed for lead and cadmium by the Extraction Procedure Toxicity test method.

4.5.2 Sample Locations and Procedures

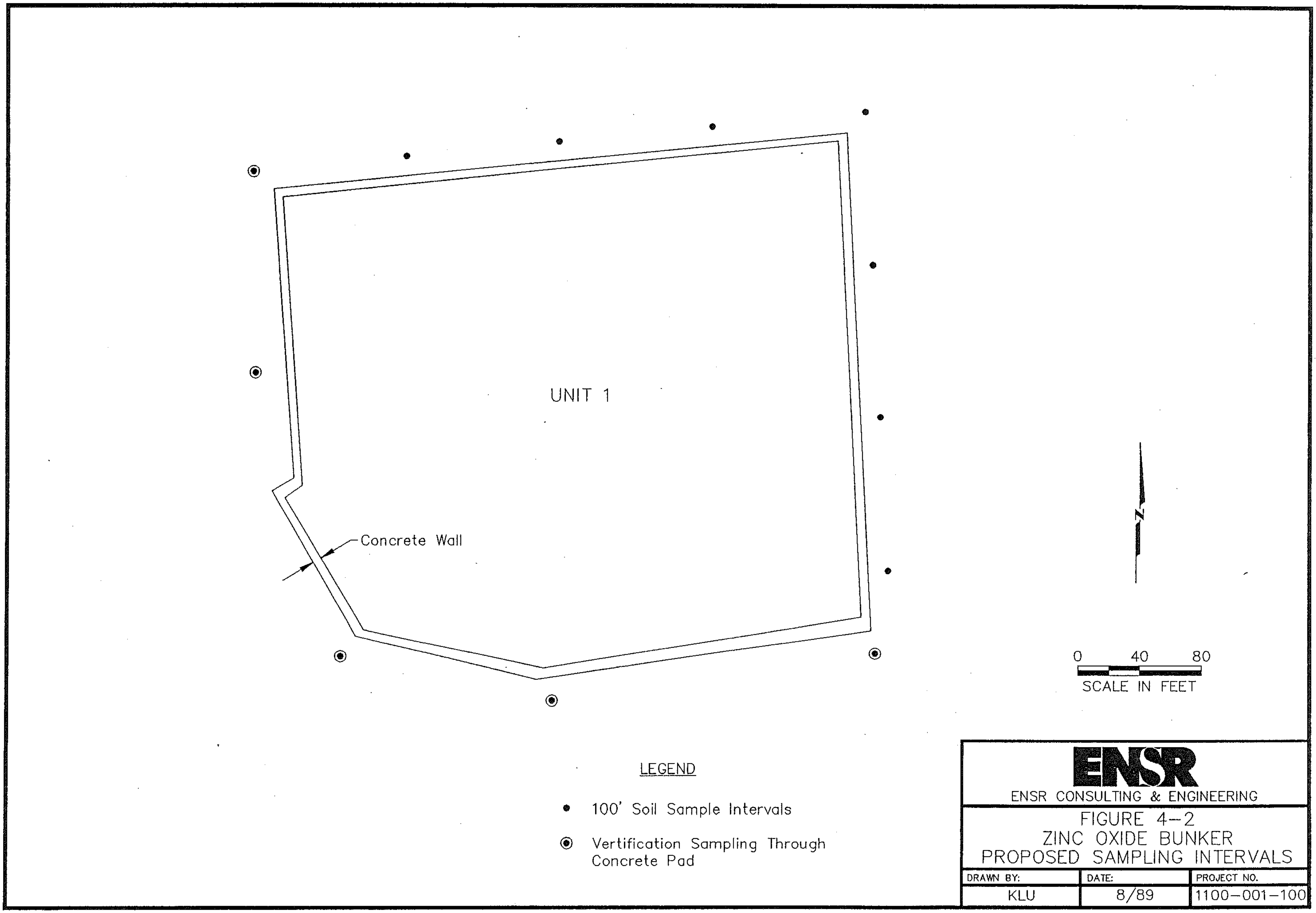
To confirm that the unit can be clean closed upon removal of all contents, samples will be collected about the perimeter of the unit, with spacing dependent upon the type of activity which has occurred and the type of material adjacent to the unit (i.e., concrete pavement or native soils covered by non-hazardous chunky slag).

Zinc oxide, zinc oxide contaminated soils and slag were transferred into the bunker structure by endloader. These contents will likewise be transferred out of the bunker during closure using endloaders or conveyors. These future activities will in almost all cases be conducted on the existing concrete pad or within the concrete-floored bunker. As necessary during the closure process and at the completion of removal of bunker contents, the floor and concrete pad will be swept to remove any minor spillage of zinc oxide or associated materials which may occur. Therefore, limited soil sampling will be conducted about the perimeter of the unit on those sides (south and west) which are concrete paved. On the remaining sides (north and east) which are unpaved but covered with slag, perimeter sampling will be conducted on a closer spacing.

In paved areas, clean closure confirmation samples will be collected on approximately 300 foot spacings, with initial borings to be made no greater than five feet out from the edge of the bunker structure. Proposed boring locations are shown in Figure 4-2. Initially, the concrete pad will be cored at each of the sampling locations to permit access to underlying soil by either hand auger, driven sampling tube or a continuous sampling device advanced by the drill rig which was used to perform the concrete coring. Once access to underlying soil has been accomplished, the soil will first be observed for significant visible contamination by zinc oxide materials. If significant contamination is apparent, the boring will be terminated and a new boring drilled five feet out from the original. If, as expected, no visible contamination is detected, soil samples will be collected at the 0-1 and 1-2 foot depth intervals by hand auger, driven sampling tube or continuous sampler, as appropriate.

Between samples the sampling equipment will be decontaminated by a hot water and non-foaming detergent wash, followed by a tap water rinse, followed by a deionized water rinse. At each sampling point, the auger or tube will be advanced to a one foot depth, the sample retrieved, and the sample immediately placed in a laboratory prepared glass container, labeled and held on ice for shipment to Midco's St. Louis, MO laboratory. Any downhole sampling equipment coming into contact with the samples will be decontaminated as outlined above. This same procedure will then be repeated at the 1-2 foot depth interval at that sampling point. The exercise will then be conducted at the remaining perimeter sampling locations. All samples will then be shipped to the laboratory following chain of custody procedures where they will be analyzed for EP toxic lead and cadmium concentrations. Samples from the 0 to 1 foot depth interval will be analyzed initially; samples from the second interval will be held for

110011A



UNIT 1
Concrete Wall
N
0 40 80
SCALE IN FEET
LEGEND
100' Soil Sample Intervals
Vertification Sampling Through Concrete Pad
ENSR
ENSR CONSULTING & ENGINEERING
FIGURE 4-2
ZINC OXIDE BUNKER
PROPOSED SAMPLING INTERVALS
DRAWN BY: KLU
DATE: 8/89
PROJECT NO. 1100-001-100

possible analyses based on results from the first interval. The sampling locations will be flagged for future reference. All sampling equipment will then be decontaminated before leaving the site and rinsewaters collected.

In unpaved areas, clean closure confirmation samples will be collected on approximate 100 foot spacings, with initial borings to be made no greater than five feet out from the edge of the bunker structure. These proposed boring locations are also shown in Figure 4-2. Currently, these locations are overlain by non-hazardous chunky slag. Initially, Chemetco will use an endloader or similar equipment to remove slag to grade until native soils are exposed. Soil sampling will then proceed at the locations proposed, with samples collected at the 0-1 and 1-2 foot depth intervals by hand auger or driven sampling tube, as appropriate.

Between samples the sampling equipment will be decontaminated by a hot water and non-foaming detergent wash, followed by a tap water rinse, followed by a deionized water rinse. At each sampling point, the auger or tube will be advanced to a one foot depth, the sample retrieved, and the sample immediately placed in a laboratory prepared glass container, labeled and held on ice for shipment to Midco's St. Louis, MO laboratory. Any downhole sampling equipment coming into contact with the samples will be decontaminated as outlined above. This same procedure will then be repeated at the 1-2 foot depth interval at that sampling point. The exercise will then be conducted at the remaining sampling locations. All samples will then be shipped to the laboratory, following chain of custody procedures, and analyzed for EP Toxicity lead and cadmium concentrations. Samples from the 0 to 1 foot interval only will be analyzed initially. Samples from the 1-2 foot interval will be held for possible analysis based upon the results of the 0-1 foot interval analyses. The sampling locations will be flagged for future reference. All sampling equipment will then be decontaminated before leaving the site and rinsewaters collected.

Sampling will be conducted in accordance with the site Quality Assurance/Quality Control Plan provided in Appendix C. Standard Operating Procedures 7115 (Soil Sampling) and 7600 (Decontamination Procedures), both included in Appendix D, will be followed in conducting sampling activities. All workers will adhere to the site-specific health and safety plan, attached hereto as Appendix G.

4.5.3 Analytical Procedures

As described above, soil samples from the zinc oxide bunker/pile will be analyzed for EP Toxicity lead and cadmium. Soil samples will be analyzed at the Midco laboratory in St. Louis, MO following SW-846 Methods 3050 and 7000. All work will be carried out following good laboratory practices and standard SW-846 procedures in accordance with the quality assurance/quality control plan presented in Appendix E. (The plan in Appendix E is for L.C. Metals of Granite City, IL, now renamed and relocated as Midco of St. Louis, MO. The plan is applicable to the Midco facility insofar as equipment and personnel have not changed substantially.)

4.5.4 Contingency Sampling

If the perimeter samples collected exceed the cleanup goal of 0.01 mg/l cadmium then limited sampling will occur beneath the floor of the bunker for cadmium only. In the event that sampling is required beneath the floor of the bunker, Chemetco will submit a sampling plan specifying methods of sample collection and sample locations, to define the lateral and vertical extent of contamination. Based upon these results, Chemetco will evaluate the potential risks posed and assess the need for excavation or capping in place.

4.6 Closure Certification

During the closure activity, an independent, registered professional engineer will conduct periodic inspections to ensure that all critical activities (including soil sampling and, if necessary, excavation) are completed adequately and in accordance with the approved Closure Plan.

Within 60 days of completion of closure, Chemetco will submit to the Administrator of EPA Region V and the Director of the Illinois Environmental Protection Agency certification by Chemetco and an independent professional engineer registered in the State of Illinois that the facility has been closed in accordance with the approved closure plan. The certification will be signed by a responsible corporate officer, or duly authorized representative, and will contain the certification statement required under 35 Illinois Adm. Code Subtitle G, Section 702.126.

4.7 Closure Schedule

Chemetco proposes to close the zinc oxide bunker in accordance with the schedule outlined in Figure 4-3. Should events beyond the control of Chemetco occur, an amendment to the closure schedule will be submitted for Agency approval.

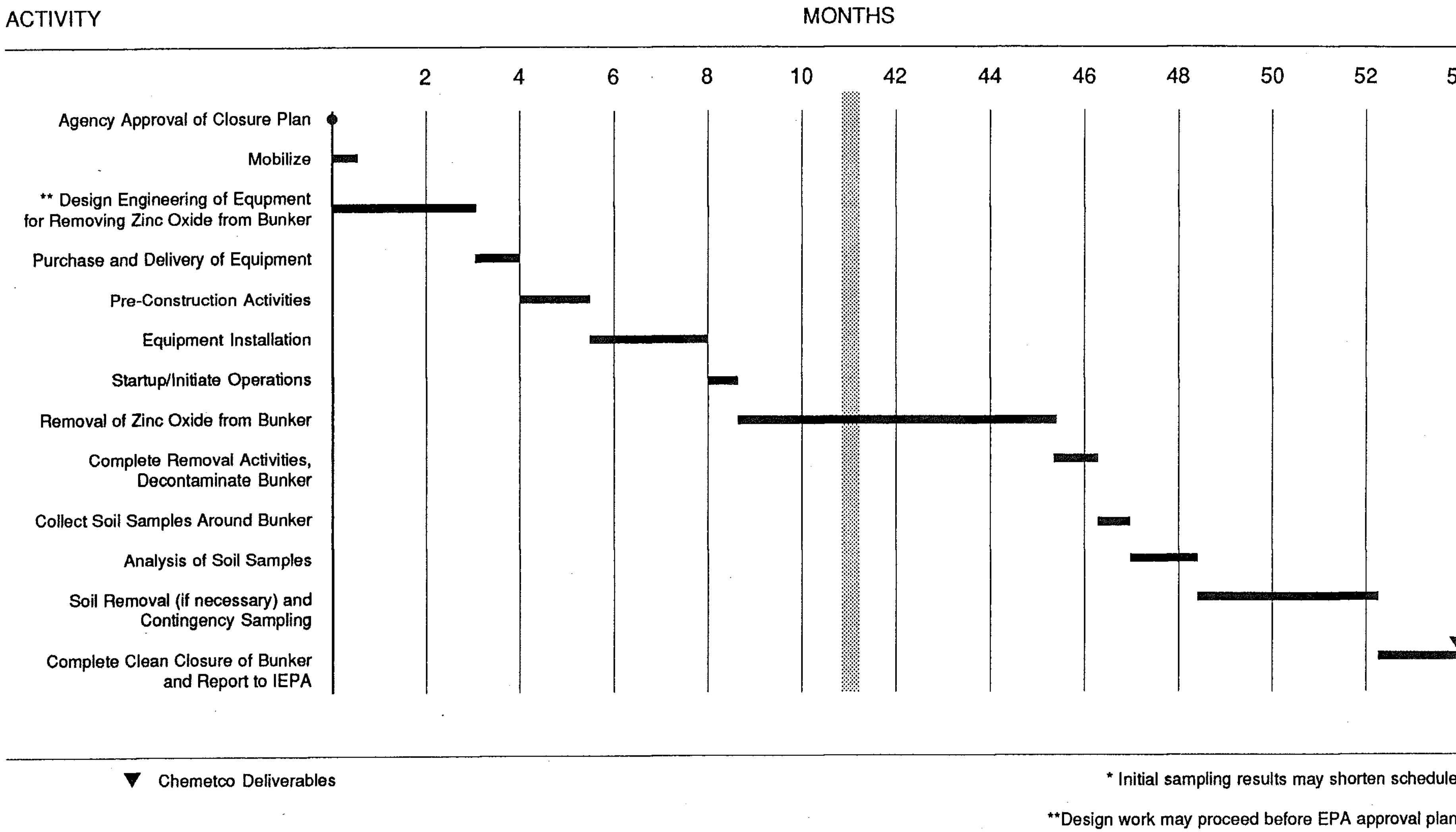


Figure 4-3

Closure Schedule for Zinc Oxide Bunker

5. COOLING WATER CANAL CLOSURE AND POST-CLOSURE PLANS

5.1 Overview

The cooling water canal consisted of a 30-40 foot wide channel excavated in the native clayey soil to a depth of about 10 feet, running along the north and east sides of the site with 2 legs extending into the center, as shown in Figure 5-1. The canal on the east originally ran as far south as 150 feet from the SE corner, as shown on Drawing L-9100-100 contained in Section IV of Chemetco's 1986 "Comprehensive Proposal" report to IEPA. The construction of the east drying pad cut this south leg of the canal back several hundred feet, as shown on the aerial photograph of 12/80, to the dimensions shown in ENSR's 10/88 Partial Closure Plan. The canal was removed from service in 1985 by dewatering and removal of subsoils. Soil testing demonstrated levels of lead and cadmium below EP toxicity standards. However, considering IEPA's soil cleanup objectives for lead and cadmium, a "clean" closure of the canals does not appear feasible at this time. Since waste materials have already been removed and only residual contamination remains in this unit, Chemetco will conduct a hybrid closure as described in Section 1, capping the existing unit with a low permeability soil cap.

5.2 Activities Completed to Date

Closure of the cooling water canal began in July and was completed in September 1985. Water in the canal was removed via two 400 gpm pumps at the northwest end of the canal. A crawler loader excavated the soils from the canal sides and bottom. Excavated material was transported from the canal to the zinc oxide storage bunker in dump trucks.

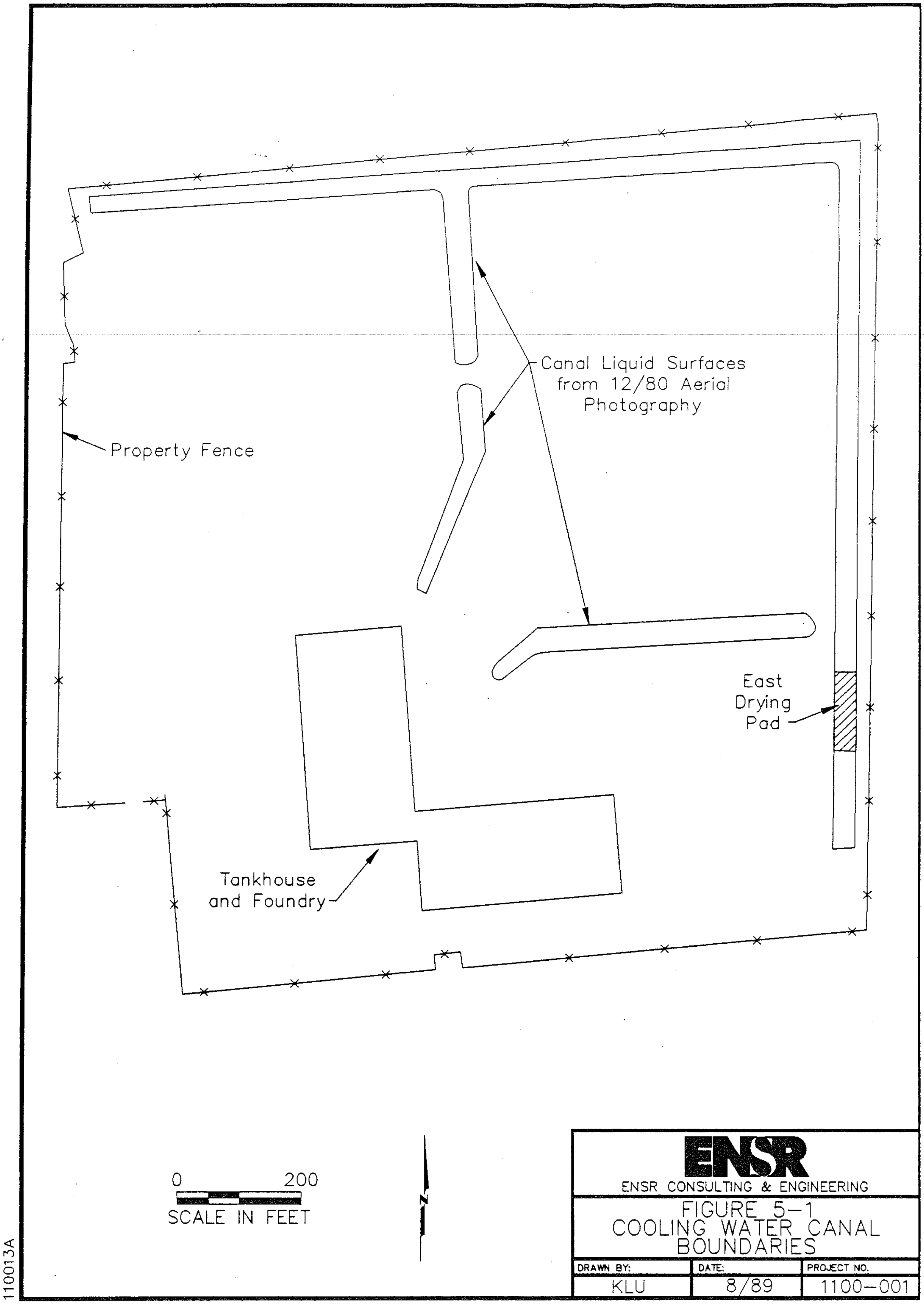


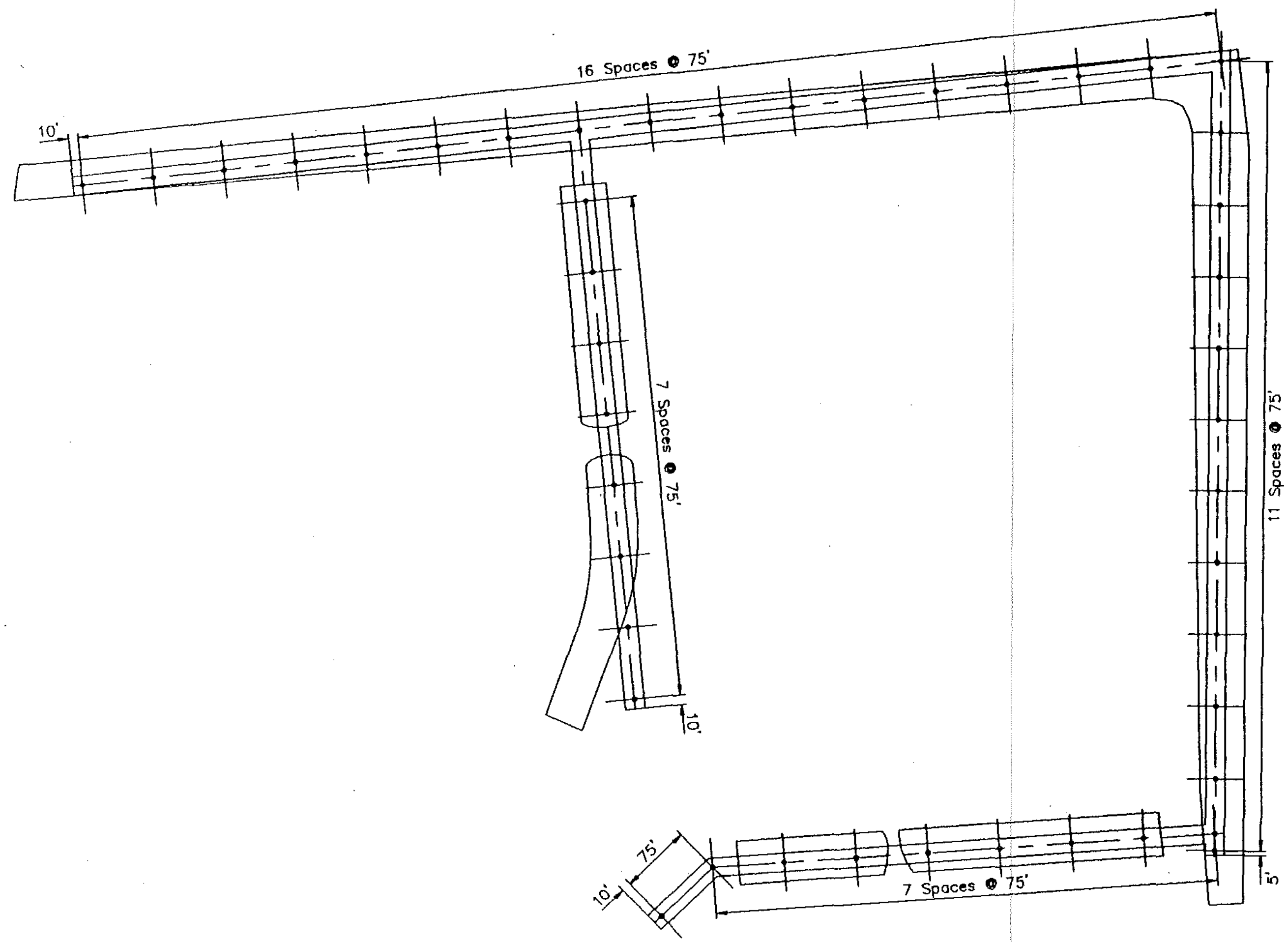
FIGURE 5-1
COOLING WATER CANAL
BOUNDARIES

A sampling grid, shown in Figure 5-2 was determined prior to the cleaning operation. The majority of the canal was divided into 75 foot intervals except at the ends where the intervals varied from 10 feet to 40 feet because either the zinc oxide in the canal was a small quantity, the length to width ratio was greater than 80:1, or the material was deposited on the canal bottom only. Samples were taken on a longitudinal center line only. A total of 48 samples were collected, and because of the known chemistry of the zinc oxide material, the soil was tested and analyzed using the EP Toxicity Test for lead and cadmium only. Analysis was performed in accordance with SW-846, Test Methods for Evaluating Solid Waste - Physical and Chemical Methods, 1982.

When lead and cadmium levels exceeded the E.P. Toxicity thresholds, soils were excavated until lead and cadmium were not detected (see Table 5-1 and Appendix I). These levels are below E.P. Toxicity standards for lead and cadmium. When soil analyses demonstrated the absence of lead and cadmium, portions of the canal were filled with slag. An estimated 80 percent of the cooling water canal was filled with approximately 255,370 tons of slag, as shown by the cross-hatching in Figure 5-3.

Closure was interrupted in 1986 when the Illinois EPA analyses found E.P. Toxic lead concentrations in soils in the canal. At that time closure activities ceased and equipment was decontaminated.

The 400 gpm pumps used for water level control and located on the north end of the canal did not show evidence of zinc oxide contamination. After being thoroughly flushed with clear water, the pumps were used in a stormwater runoff control system. The dump trucks used to transport the zinc oxide and soil removed from the canal were scraped and washed at the end of each working day. The cleaning was performed in the concreted "AAF" area near the sump and a pump used to return the wash water to the "AAF" system to reclaim the zinc oxide material. A plant high pressure water system supplied the water. The cleaning included the dump bed, undercarriage, and



LEGEND

• Former Soil Sample

0 120 240
SCALE IN FEET

N

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FIGURE 5-2
COOLING WATER CANAL
FORMER SAMPLING GRID

DRAWN BY:	DATE:	PROJECT NO.
KLU	8/89	1100-001-10

1100148

TABLE 5-1

SUMMARY EP TOXICITY TEST RESULTS

COOLING WATER CANAL

Sample No.	Lead	Cadmium	Lab
1A	BDL	BDL	ERT
2A	BDL	BDL	ERT
3A	BDL	BDL	ERT
4A	BDL	BDL	ERT
5A	BDL	BDL	ERT
6A	BDL	BDL	ERT
7A	BDL	BDL	ERT
8A	BDL	BDL	ERT
9A	BDL	BDL	ERT
10A	BDL	BDL	ERT
11A	BDL	BDL	ERT
12A	BDL	BDL	ERT
13A	BDL	BDL	ERT
14A	BDL	BDL	ERT
15A	BDL	BDL	ERT
16A	BDL	BDL	ERT
17A	BDL	BDL	ERT
18A	BDL	BDL	ERT
19A	BDL	BDL	ERT
20A	BDL	BDL	ERT
21A	BDL	BDL	ERT
22A	BDL	BDL	ERT
23A	BDL	BDL	ERT
24A	BDL	BDL	ERT
25A	BDL	BDL	ERT
26A	BDL	BDL	ERT
27A	BDL	BDL	ERT
28A	BDL	BDL	ERT
29A	BDL	BDL	ERT

TABLE 5-1 (Continued)

Sample No.	Lead	Cadmium	Lab
30A	BDL	BDL	ERT
31A	BDL	BDL	ERT
32A	BDL	BDL	ERT
33A	BDL	BDL	ERT
34A	BDL	BDL	ERT
35A	BDL	BDL	ERT
36A	BDL	BDL	ERT
37A	BDL	BDL	ERT
38A	BDL	BDL	ERT
39A	BDL	BDL	ERT
40A	BDL	BDL	ERT
41A	BDL	BDL	ERT
42A	BDL	BDL	ERT
43A	BDL	BDL	ERT
44A	BDL	BDL	ERT
45A	BDL	BDL	ERT
46A	BDL	BDL	ERT
47A	BDL	BDL	ERT
48A	BDL	BDL	ERT
49A	BDL	BDL	ERT
50A	BDL	BDL	ERT

Detection Limit: 0.05mg/l.

Analytical Method: SW 846 Method 6010

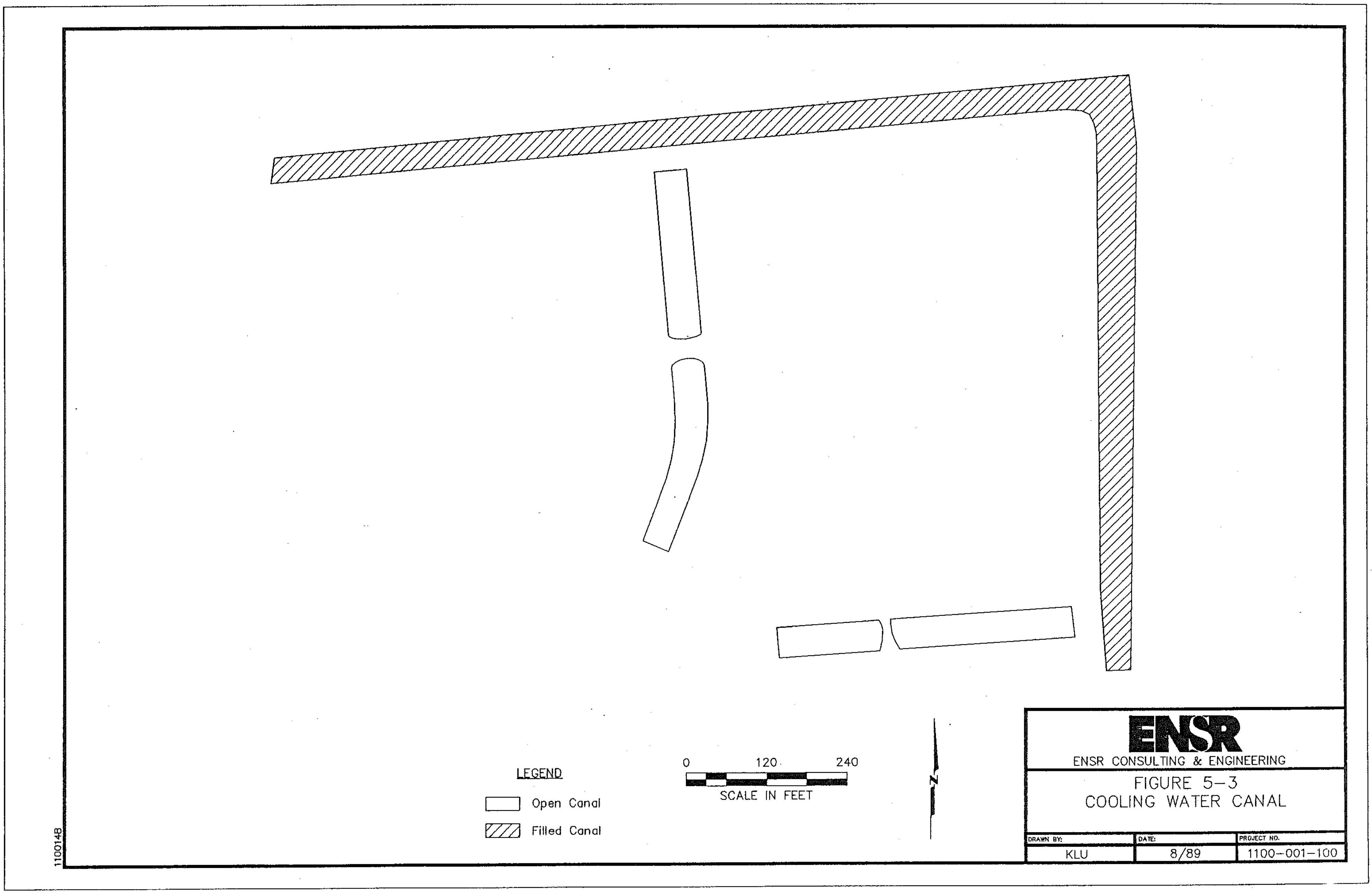

FIGURE 5-3
COOLING WATER CANAL

tires. When Chemetco stopped closing the canals, the crawler type backhoe was cleaned with the same washing system in the same area. Prior to that time, the backhoe was restricted to the immediate area of the cooling canal.

5.3 Closure Procedures

The area of the cooling water canals will be capped at the time of closure using a layered soil cover system. The components of this cover will include:

- An 18-inch thick soil layer to limit infiltration having a coefficient of permeability less than or equal to 1×10^{-7} cm/sec; and
- A 12-inch thick soil layer to support hardy shallow-root vegetation.

The cover system will be installed on the canal area shown in Figure 5-1, including the bridge area between legs and the area capped by the east drying pad. Open sections of the canal currently holding several feet of rainwater will be dewatered by pumping to the plant process water system. The east drying pad will be demolished and removed. The cap will be installed after grading and compaction of fill material from an offsite source, to establish the required base elevations. Material specifications and placement procedures are provided in Appendix L. A quality assurance testing program will be implemented during construction of the cover, as described in Appendix M. The area will be graded to establish top slopes of between 3 and 5 percent, which will promote runoff and prevent ponding. The vegetative cover will consist of a grass which will act to minimize soil erosion with a shallow root system. The existing fence surrounding the facility will prevent unauthorized access and disturbance of the cover system, which will be constructed after plant shutdown.

Chemetco will prepare detailed engineering specifications and drawings for this cover system after IEPA conditional approval of these closure plans. The detailed specifications will be based on a survey to establish the limits of the cover system and the existing grades. Surveying will be performed with respect to permanent benchmarks by a professional land surveyor. Specifications and drawings will be sealed and signed by a professional engineer. The detailed specifications will be submitted for IEPA approval as an addendum to these closure plans within 90 days of IEPA's conditional plan approval.

5.4 Post-Closure Care

Chemetco does not plan to use the capped area for industrial or commercial purposes after closure. If any adjoining areas within the fenced property are used, the capped area will be posted to warn the adjacent users against disturbance of the landfill or cover system. If the fenced property is accessible to authorized motor vehicles, barriers will be placed to prevent vehicular access to the capped area. In no case will post-closure use of the property be allowed to disturb the final cover system.

Post-closure care will begin after completion of the closure certification and will continue for 30 years, unless the care period is shortened or extended by IEPA. Post-closure care will consist of groundwater monitoring as described in the following subsection, and maintenance of the final cover as described herein. The cover system will be inspected quarterly during the first two years and semiannually thereafter. Specific components to be inspected include:

- fence integrity
- condition of vegetation
- soil erosion

- soil cracking
- surface grades, potential for ponding

Maintenance will be conducted as necessary to maintain effectiveness of the cover system, including fence repair, removal of deep-rooted plants, fertilizing, backfilling washouts or low spots, seeding, and diversion of run-on/run-off. Maintenance will be conducted during the inspections if possible, or otherwise as soon as possible considering weather conditions and the availability of materials and personal. The facility contact during the post-closure care period is:

Ms. Michelle Reznack, Environmental Manager
Chemetco, Inc.
P.O. Box 187
Alton, IL 62002
(618) 254-4381

5.5 Certifications and Notices

During the closure activity and post-closure care, an independent, registered professional engineer will conduct periodic inspections to ensure that all critical activities are completed adequately and in accordance with the approved Closure and Post-Closure Plans.

Within 60 days of completion of closure, Chemetco will submit to the Administrator of EPA Region V and the Director of the Illinois Environmental Protection Agency certification by Chemetco and an independent professional engineer registered in the State of Illinois that the facility has been closed in accordance with the approved closure plan. Likewise, within 60 days of completion of post-closure care, certification will be submitted that the approved post-closure plan was followed. The certification will be signed by a responsible corporate officer, or duly authorized representative, and will contain the certification statement required under 35 Illinois Adm. Code Subtitle G, Section 702.126.

Chemetco will submit a survey plat at at the time of closure certification to both IEPA and the local zoning authority. The plat will indicate the location of the cooling water canals with respect to permanently surveyed benchmarks, will note that the area's future use is restricted, and will be prepared and certified by a professional land surveyor. Within 60 days of closure certification Chemetco will submit a record of types, amounts, and location of waste materials or residuals in the cooling water canals to both IEPA and the local zoning authority. Within 60 days of closure certification Chemetco will also record a notation on the property deed, and submit certification that such a notation has been made, in accordance with 35 Ill. Adm. Code 724, Subpart G. This notation will alert any potential purchaser of the property that the land has been used to manage hazardous waste and its future use is restricted to a shallow-rooted grassland or non-residential or commercial development (i.e., parking area).

5.6 Closure Schedule

Chemetco proposes to close the cooling water canal in accordance with the schedule outlined in Figure 5-4. The time periods and sequences shown in Figure 5-4 may be influenced by weather conditions and seasonal effects. Should events beyond the control of Chemetco occur, an amendment to the closure schedule will be submitted for Agency approval.

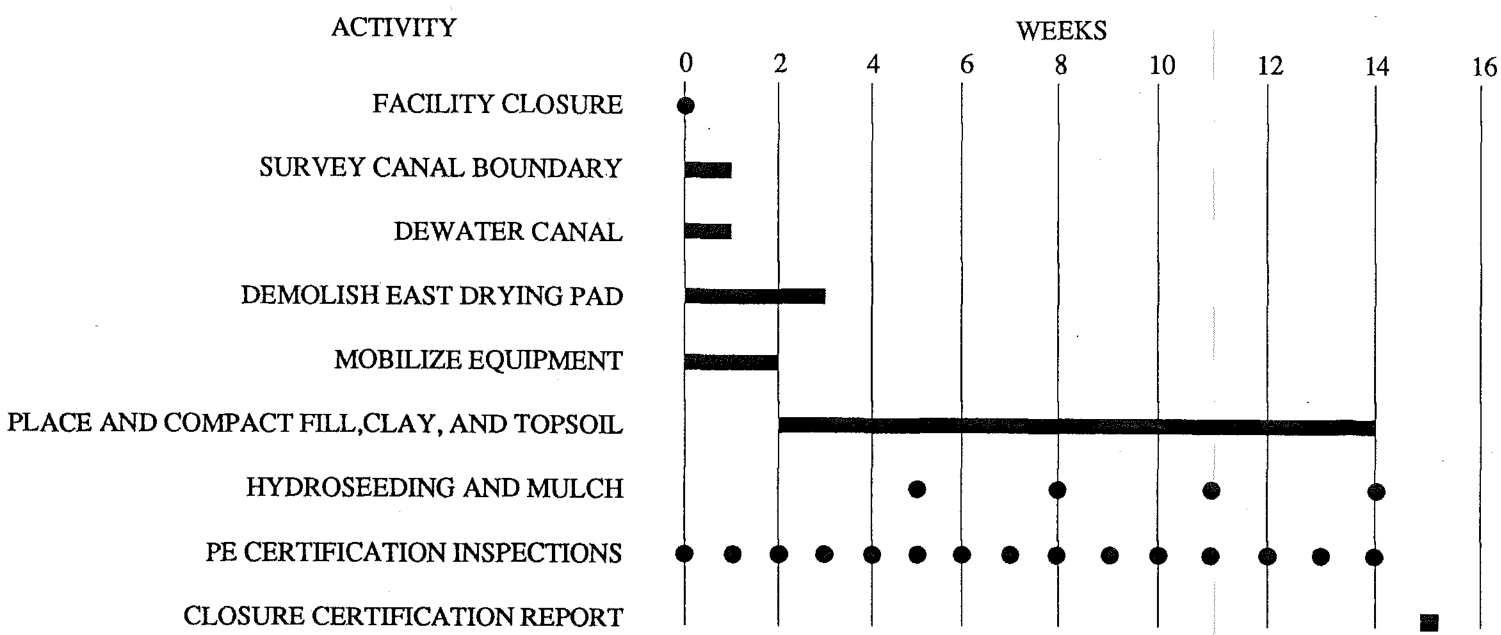

Figure 5-4
Closure Schedule for Cooling Water Canals

6. ZINC OXIDE LAGOONS CLOSURE AND POST-CLOSURE PLANS

6.1 Overview

The zinc oxide lagoons were two parallel soil-lined excavations approximately 25 feet wide, 180 feet long, and 15 feet deep which served as settling units for the slurry produced from the zinc oxide production system. The settled solids were either sold or stored in the zinc oxide pile for additional dewatering. The lagoons were contained by an approximately 8-inch aggregate berm around the top perimeter, which in combination with the higher local topography, diverted runoff away from the pits. Underlying clay provided vertical containment. The location of these units is well documented by aerial photography of 12/80, 4/82, and 11/84, and is shown in Figure 6-1.

The lagoon contents and center dividing wall were removed in 1985. Sub-soils were tested and found to have levels of lead and cadmium below EP Toxicity standards. However, considering IEPA's soil cleanup objectives for lead and cadmium, a "clean" closure of the lagoons does not appear feasible at this time. Since waste materials have already been removed and only residual contamination remains in this unit, Chemetco will conduct a hybrid closure as described in Section 1, capping the existing unit with a low permeability soil cap.

6.2 Activities Completed to Date

Decommissioning of the lagoons began in January and was completed in February of 1985. The lagoon contents and the center dividing wall were removed with a large backhoe working from the east to the west end of the lagoons. Soil samples were collected at a 20 foot by 40 foot grid interval from the lagoon bottom and at an approximately 10 foot by 40 foot interval from the lagoon side and end walls, at locations shown in Figure 6-2. Samples were collected and analyzed for E.P.

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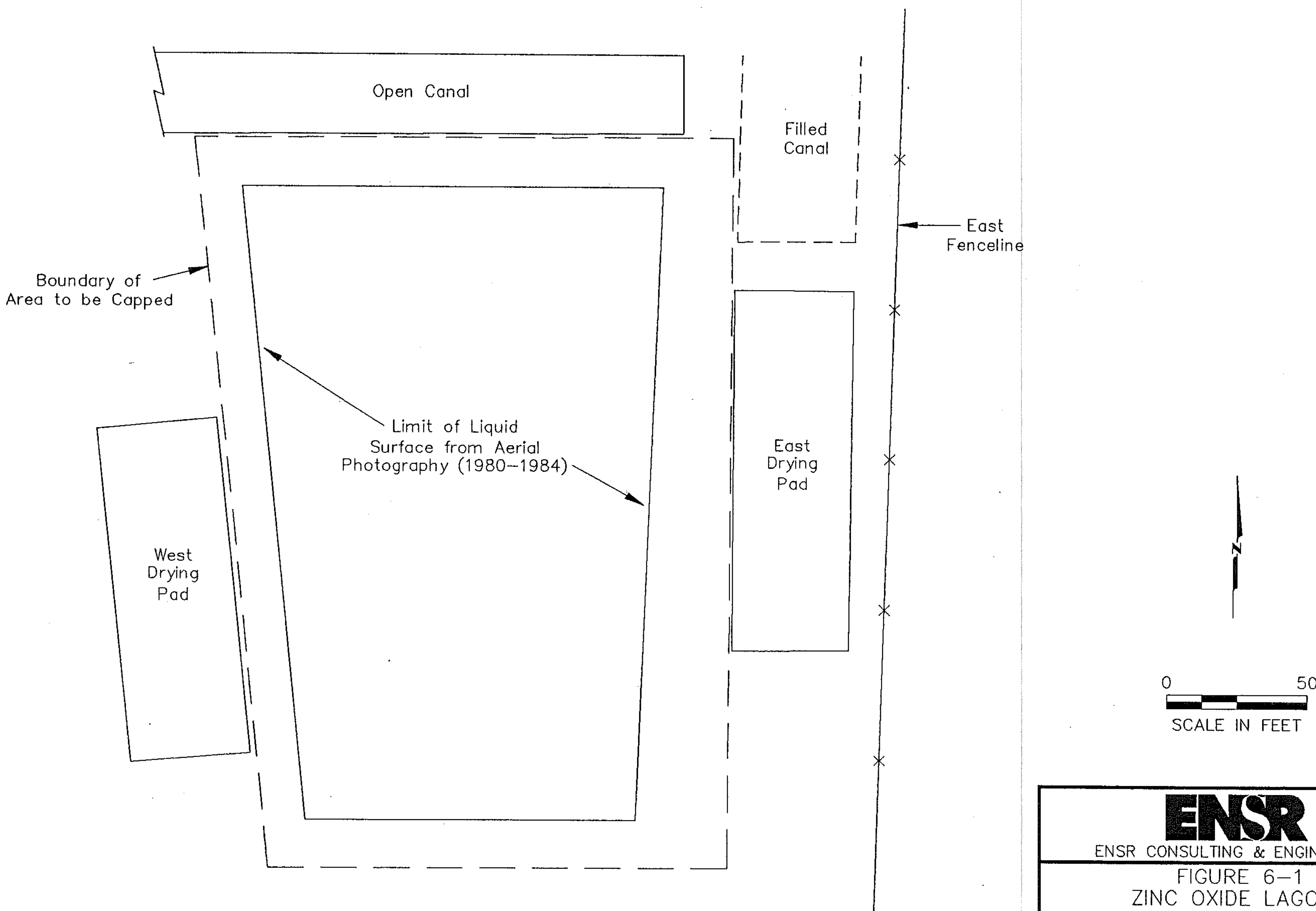

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FIGURE 6–1
ZINC OXIDE LAGOON BOUNDARIES

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KLU	8/89	1100–001

Toxicity for lead and cadmium. The results of these analyses are summarized in Table 6-1 and included as Appendix J. These levels are all below E.P. toxicity standards for lead and chromium. Following removal, the excavated area was filled with an estimated 74,274 tons of slag.

All equipment was decontaminated in the concrete "AAF" unit. The piping and pumps used to transfer the zinc oxide slurry to the pits and to return process water to the scrubber unit, were cleaned with high pressure water in a concrete area of the "AAF" unit. The wash water was collected in a sump and pumped back to the "AAF" scrubber to recover any metals and zinc oxide material. The clean pump was put into service in a different area of the plant. The piping was cut to short lengths, cleaned with high pressure water in the "AAF" area, filled with concrete and used to construct protective "bumpers" around several groundwater monitoring well locations.

All dump trucks used to transfer zinc oxide material from the lagoons to the storage bunker were decontaminated daily. At the end of each day during the pit closing operation, the dump trucks used to haul the zinc oxide material to the new storage area were scraped and washed. Decontamination included a high pressure water rinse of both the truck beds and the tires. All decontamination activities were performed in a concrete area of the "AAF" unit that contained a sump and pump. Wash and rinse water was pumped into the "AAF" unit to reclaim zinc oxide material.

6.3 Closure Procedures

The area of the zinc oxide lagoons will be capped at the time of closure using a layered soil cover system. The components of this cover will include:

- An 18-inch thick soil layer to limit infiltration, having a coefficient of permeability less than or equal to $1x10^{-7}$ cm/sec; and

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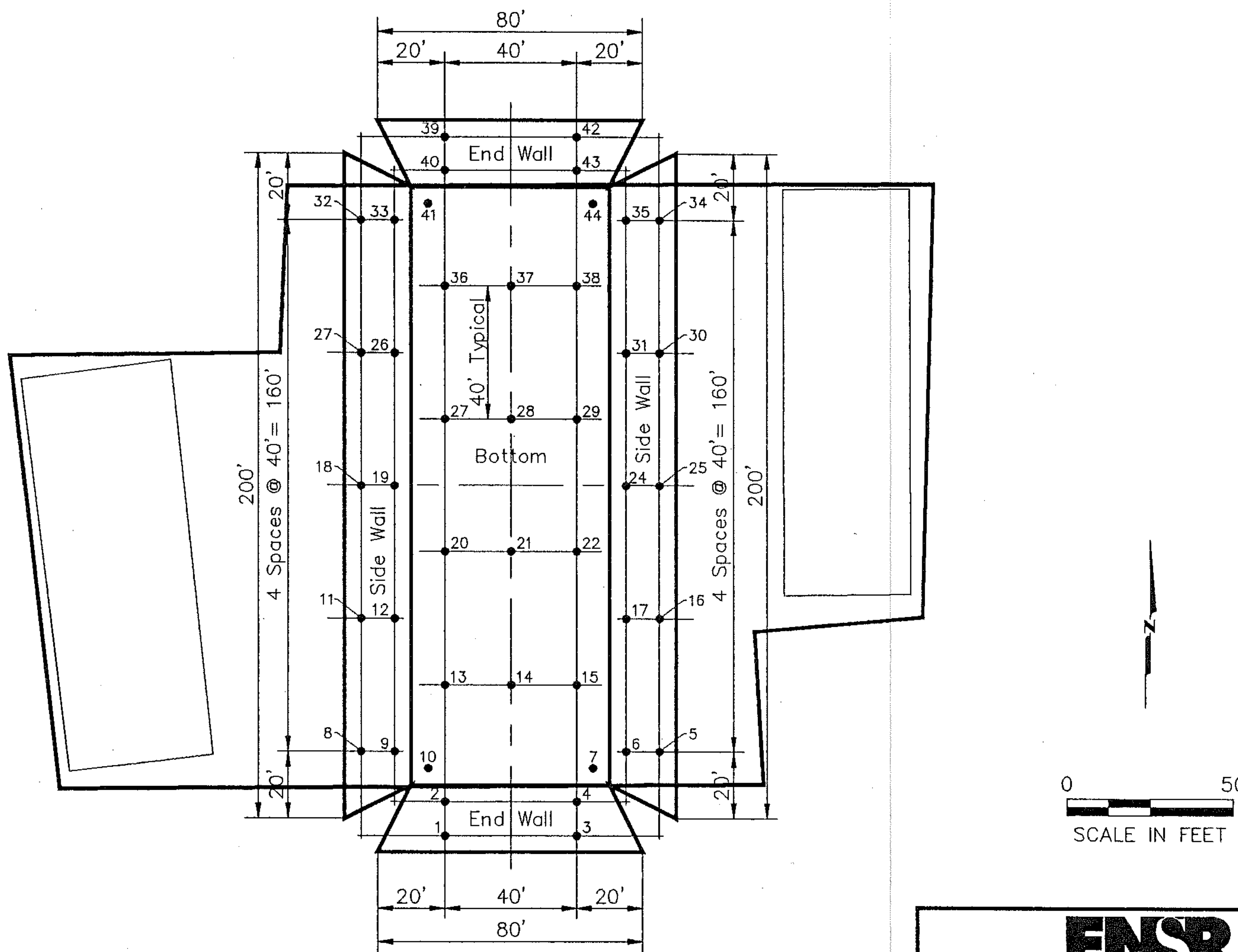

LEGEND

● Former Soil Sample

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FIGURE 6-2
ZINC OXIDE LAGOONS
FORMER SAMPLING GRID

DRAWN BY:	DATE:	PROJECT NO.
KLU	8/89	1100-001

TABLE 6-1

SUMMARY OF EP TOXICITY TEST RESULTS

ZINC OXIDE LAGOONS

Sample No.	Lead (mg/l)	Cadmium (mg/l)	Lab
1	0.016	0.005	EA*
2	0.1	0.01	EA
3	0.017	0.005	EA
4	0.1	0.01	EA
5	0.014	0.005	EA
6	0.1	0.01	EA
7	0.016	0.005	EA
8	0.023	0.005	EA
9	0.1	0.01	EA
10	0.018	0.005	EA
11	0.021	0.01	EA
12	0.017	0.01	EA
13	1.08	0.005	EA
14	0.21	0.005	EA
15	0.006	0.005	EA
16	0.009	0.005	EA
17	0.012	0.01	EA
18	0.011	0.01	EA
19	0.009	0.005	EA
20	0.027	0.01	EA
21	0.1	0.01	LC
22	0.1	0.01	EA
23	0.1	0.1	EA
24	0.011	0.01	EA
25	0.085	0.01	EA
26	0.1	0.01	EA
27	0.009	0.01	EA
28	0.013	0.01	EA
29	0.1	0.01	EA
30	0.009	0.01	EA
31	0.1	0.01	EA
32	0.031	0.01	EA
33	0.013	0.005	EA
34	0.012	0.01	EA
35	0.008	0.01	EA
36	0.024	0.01	EA
37	0.023	0.01	EA
38	0.101	0.005	EA
39	0.01	0.005	EA
40	0.1	0.01	EA
41	0.011	0.01	EA
42	0.005	0.01	EA
43	0.008	0.005	EA
44	0.127	0.01	LC

*"EA" Represents Environmental Analytical
7003H 1100-001-100-100R

- A 12-inch thick soil layer to support hardy shallow-root vegetation.

The cover system will be installed on the area shown in Figure 6-1, which is the maximum areal extent of the lagoons based on aerial photography and the limits of surrounding structures. The cap will be installed after grading and compaction of fill material from an offsite source, to establish the required base elevations. Material specifications and placement procedures are provided in Appendix L. A quality assurance testing program will be implemented during construction of the cover, as described in Appendix M. The area will be graded to establish top slopes of between 3 and 5 percent, which will promote runoff and prevent ponding. The vegetative cover will consist of a grass which will act to minimize soil erosion with a shallow root system. The existing fence surrounding the facility will prevent unauthorized access and disturbance of the cover system, which will be constructed after plant shutdown.

Chemetco will prepare detailed engineering specifications and drawings for this cover system after IEPA conditional approval of these closure plans. The detailed specifications will be based on a survey to establish the limits of the cover system and the existing grades. Surveying will be performed with respect to permanent benchmarks by a professional land surveyor. Specifications and drawings will be sealed and signed by a professional engineer. The detailed specifications will be submitted for IEPA approval as an addendum to these closure plans within 90 days of IEPA's conditional plan approval.

6.4 Post-Closure Care

Chemetco does not plan to use the capped area for industrial or commercial purposes after closure. If any adjoining areas within the fenced property are used, the capped area will be posted to warn the adjacent users against disturbance of the landfill or cover system. If the fenced property is accessible to authorized motor vehicles, barriers will be placed to prevent vehicular access to the capped area. In no case will post-closure use of the property be allowed to disturb the final cover system.

Post-closure care will begin after completion of the closure certification and will continue for 30 years, unless the care period is shortened or extended by IEPA. Post-closure care will consist of groundwater monitoring as described in the following subsection, and maintenance of the final cover as described herein. The cover system will be inspected quarterly during the first two years semiannually thereafter. Specific components to be inspected include:

- fence integrity
- condition of vegetation
- soil erosion
- soil cracking
- surface grades, potential for ponding

Maintenance will be conducted as necessary to maintain effectiveness of the cover system, including fence repair, removal of deep-rooted plants, fertilizing, backfilling washouts or low spots, seeding, and diversion of run-on/run-off. Maintenance will be conducted during the inspections if possible, or otherwise as soon as possible considering weather conditions and the availability of materials and personal. The facility contact during the post-closure care period is:

Ms. Michelle Reznack, Environmental Manager
Chemetco, Inc.
P.O. Box 187
Alton, IL 62002
(618) 254-4381

6.5 Certifications and Notices

During the closure activity and post-closure care, an independent, registered professional engineer will conduct periodic inspections to ensure that all critical activities are completed adequately and in accordance with the approved Closure and Post-Closure Plans.

Within 60 days of completion of closure, Chemetco will submit to the Administrator of EPA Region V and the Director of the Illinois Environmental Protection Agency certification by Chemetco and an independent professional engineer registered in the State of Illinois that the facility has been closed in accordance with the approved closure plan. Likewise, within 60 days of completion of post-closure care, certification will be submitted that the approved post-closure plan was followed. The certification will be signed by a responsible corporate officer, or duly authorized representative, and will contain the certification statement required under 35 Illinois Adm. Code Subtitle G, Section 702.126.

Chemetco will submit a survey plat at at the time of closure certification to both IEPA and the local zoning authority. The plat will indicate the location of the zinc oxide lagoons with respect to the permanently surveyed benchmarks, will note that the area's future use is restricted and will be prepared and certified by a professional land surveyor. Within 60 days of closure certification Chemetco will submit a record of types, amounts, and location of waste materials or residuals in the zinc oxide lagoons to both IEPA and the local zoning authority. Within 60 days of closure certification Chemetco will also record a notation on the property deed, and submit certification that such a notation has been made, in accordance with 35 Ill. Adm. Code 725, Subpart G. This notation will alert any potential purchaser of the property that the land has been used to manage hazardous waste and its future use is restricted to a shallow-rooted grassland or non-residential or commercial development (i.e., parking area).

6.6 Closure Schedule

Chemetco proposes to close the zinc oxide lagoons in accordance with the schedule outlined in Figure 6-3. The time periods and sequences shown in Figure 6-3 may be influenced by weather conditions and seasonal effects. Should events beyond the control of Chemetco occur, an amendment to the closure schedule will be submitted for Agency approval.

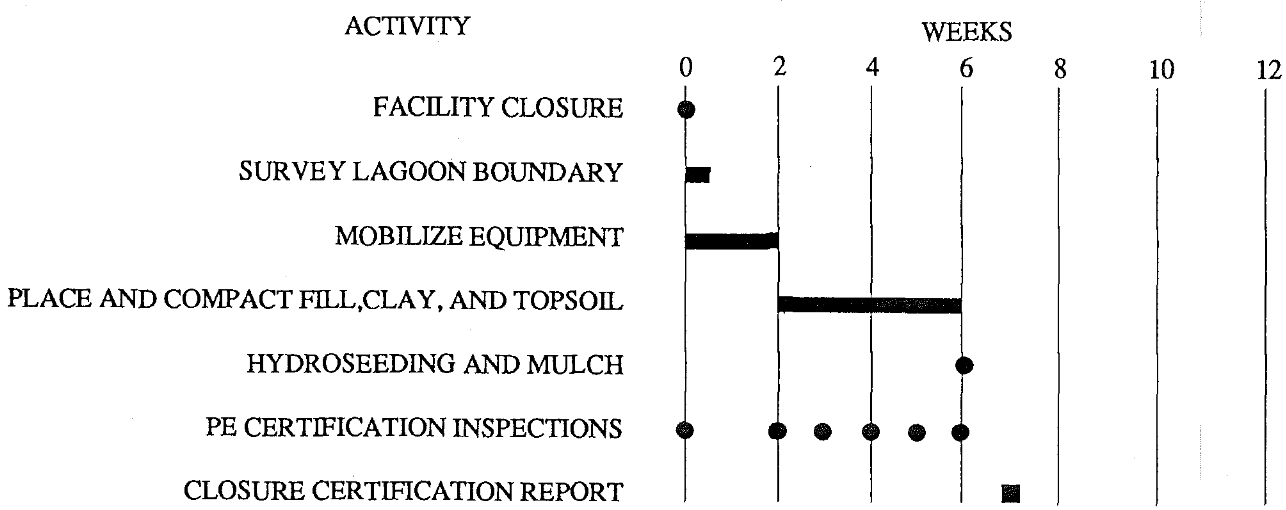

FIGURE 6-3
Closure Schedule for Zinc Oxide Lagoons

7. FLOOR WASH WATER IMPOUNDMENT CLOSURE AND POST-CLOSURE PLANS

7.1 Overview

In association with the electrolytic refining of copper anodes, a process since discontinued at Chemetco, the company operated an impoundment referred to as the floor wash water impoundment or acid pit. As the name implies, the unit received acid spills from the tankhouse which were flushed by water from the building into a depression located in the southeastern portion of the plant facility. Use of the impoundment ceased in 1980, and the unit was closed by backfilling in 1981. The location of the floor wash water impoundment has been established by aerial photography, and confirmed by preliminary test pitting.

Because groundwater contamination detected beneath the facility appears to be related to this unit, a "clean" closure of the impoundment does not appear feasible under current U.S. and Illinois EPA policy and guidance. Therefore, the impoundment is being closed in accordance with landfill standards, by capping in-place waste materials. The cap to be used for this unit is a composite soil/geomembrane cover system.

7.2 Activities Completed to Date

The precise date of construction and first use of the floor wash water impoundment are not conclusively known. It is known that use of the unit was discontinued sometime in 1980. It is suspected that some contents were left in place and the impoundment backfilled with slag in 1981. In early 1984 an acid recovery trench was installed south of the facility just south of Oldenberg Road. This trench was replaced in 1984 by the subsurface interceptor drainage system (SIDS). The SID System has operated continuously since installation, collecting over 89,000 gallons of groundwater per month. The collected groundwater is used in the production of zinc oxide.

Chemetco has established the location of the floor wash water impoundment based on aerial photography and preliminary test pitting. Aerial photography of 12/11/80 shows an impoundment in the area that was indicated by Chemetco in their 1986 "Comprehensive Proposal" report to IEPA (Section IV, Appendix A sheet 2 of 2). The test pitting was conducted on October 13, 1988, and is detailed in Appendix K. One of the test pit excavations, TP-9, showed evidence of cupric compounds by blue coloring of the slag/fill. Cupric compounds are likely constituents of the impoundment wastes considering the waste source, electrolytic refining of copper. The location of the impoundment, based on the aerial photography and test pitting, is shown in Figure 7-1.

7.3 Closure Procedures

The area of the floor wash water impoundment, which has been filled with slag since 1981, will be capped at the time of closure using a composite soil/geomembrane cover system. The components of this cover are described below:

- A 24-inch thick soil layer to limit infiltration and act as a buffer between the geomembrane and the in-place fill materials. The coefficient of permeability of this layer will be less than $1x10^{-7}$ cm/sec;
- A 30-mil thick geomembrane to limit infiltration while accommodating settling and subsidence;
- A geotextile layer to protect the geomembrane from abrasion by overlying drainage material;
- A 12-inch thick drainage layer to conduct infiltration off of the geomembrane and act as a protective buffer for the geomembrane. This layer will consist of coarse sand having a minimum saturated hydraulic conductivity of $1x10^{-3}$ cm/sec;

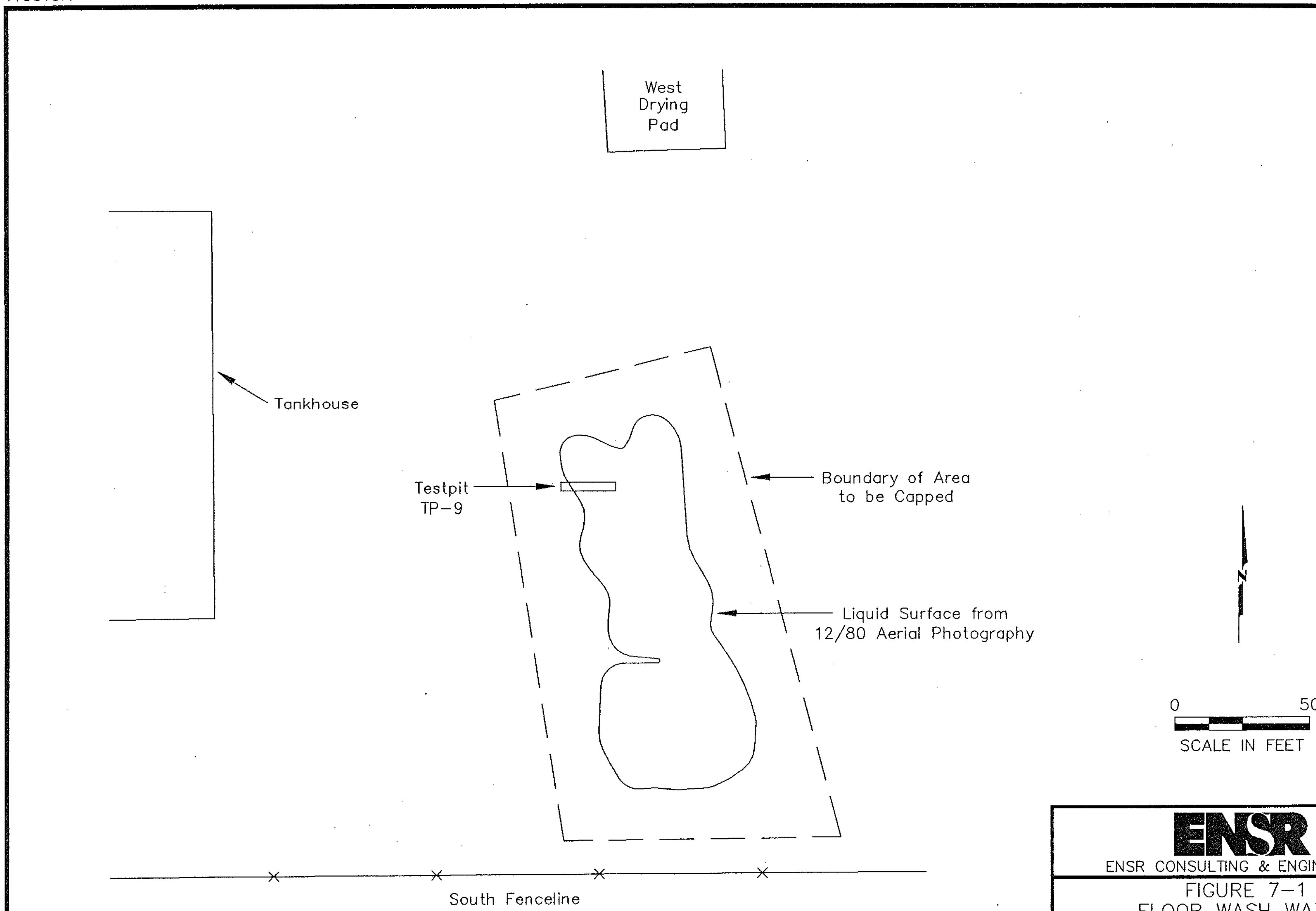

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FIGURE 7-1
FLOOR WASH WATER
IMPOUNDMENT BOUNDARIES

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- A geotextile layer to prevent clogging of the drainage layer from soil fines;
- An 18-inch thick fill layer to provide soil moisture retention and to buffer the underlying layers from root and rodent penetration; and
- A 6-inch thick soil layer to support hardy shallow-root vegetation.

The cover system will be installed on the area shown in Figure 7-1 after grading and compacting fill material from an offsite source, to establish the required base elevations. Material specifications and placement procedures are provided in Appendix N. A quality assurance testing program will be implemented during construction of the cover, as described in Appendix O. The area will be graded to establish top slopes of between 3 and 5 percent, which will promote runoff and prevent ponding. The vegetative cover will consist of a grass which will act to minimize soil erosion with a shallow root system. The existing fence surrounding the facility will prevent unauthorized access and disturbance of the cover system, which will be constructed after plant shutdown.

Chemetco will prepare detailed engineering specifications and drawings for this cover system after IEPA conditional approval of these closure plans. The detailed specifications will be based on a survey to establish the limits of the cover system and the existing grades. Surveying will be performed with respect to permanent benchmarks by a professional land surveyor. Specifications and drawings will be sealed and signed by a professional engineer. The detailed specifications will be submitted for IEPA approval as an addendum to these closure plans within 90 days of IEPA's conditional plan approval.

7.4 Post-Closure Care

Chemetco does not plan to use the capped area for industrial or commercial purposes after closure. If any adjoining areas within the fenced property are used, the capped area will be posted to warn the adjacent users against disturbance of the landfill or cover system. If the fenced property is accessible to authorized motor vehicles, barriers will be placed to prevent vehicular access to the capped area. In no case will post-closure use of the property be allowed to disturbe the final cover system.

Post-closure care will begin after completion of the closure certification and will continue for 30 years, unless the care period is shortened or extended by IEPA. Post-closure care will consist of groundwater monitoring as described in the following subsection, and maintenance of the final cover as described herein. The cover system will be inspected quarterly during the first two years and semiannually thereafter. Specific components to be inspected include:

- fence integrity
- condition of vegetation
- soil erosion
- soil cracking
- surface grades, potential for ponding

Maintenance will be conducted as necessary to maintain effectiveness of the cover system, including fence repair, removal of deep-rooted plants, fertilizing, backfilling washouts or low spots, seeding, and diversion of run-on/run-off. Maintenance will be conducted during the inspections if possible, or otherwise as soon as possible considering weather conditions and the availability of materials and personal. The facility contact during the post-closure care period is:

Ms. Michelle Reznack, Environmental Manager
Chemetco, Inc.
P.O. Box 187
Alton, IL 62002
(618) 254-4381

7.5 Certifications and Notices

During the closure activity and post-closure care, an independent, registered professional engineer will conduct periodic inspections to ensure that all critical activities are completed adequately and in accordance with the approved Closure and Post-Closure Plans.

Within 60 days of completion of closure, Chemetco will submit to the Administrator of EPA Region V and the Director of the Illinois Environmental Protection Agency certification by Chemetco and an independent professional engineer registered in the State of Illinois that the facility has been closed in accordance with the approved closure plan. Likewise, within 60 days of completion of post-closure care, certification will be submitted that the approved post-closure plan was followed. The certification will be signed by a responsible corporate officer, or duly authorized representative, and will contain the certification statement required under 35 Illinois Adm. Code Subtitle G, Section 702.126.

Chemetco will submit a survey plat at the time of closure certification to both IEPA and the local zoning authority. The plat will indicate the location of the floor wash water impoundment with respect to permanently surveyed benchmarks, will note that the area's future use is restricted, and will be prepared and certified by a professional land surveyor. Within 60 days of closure certification Chemetco will submit a record of types, amounts, and location of waste materials in the floor wash water impoundment, to both IEPA and the local zoning authority. Within 60 days of closure certification Chemetco will also record a notation on the property deed, and submit certification that such a notation has been made, in accordance with 35 Ill. Adm. Code 725, Subtitle G, Part 72. This notation will alert any potential purchaser of the property that the land has been used to manage hazardous wastes and its future use is restricted to a shallow-rooted grassland or non-residential or commercial development (i.e., parking area).

7.6 Closure Schedule

Chemetco proposes to close the floor wash water impoundment in accordance with the schedule outlined in Figure 7-2. The time periods and sequences shown in Figure 7-2 may be influenced by weather conditions and seasonal effects. Should events beyond the control of Chemetco occur, an amendment to the closure schedule will be submitted for Agency approval.

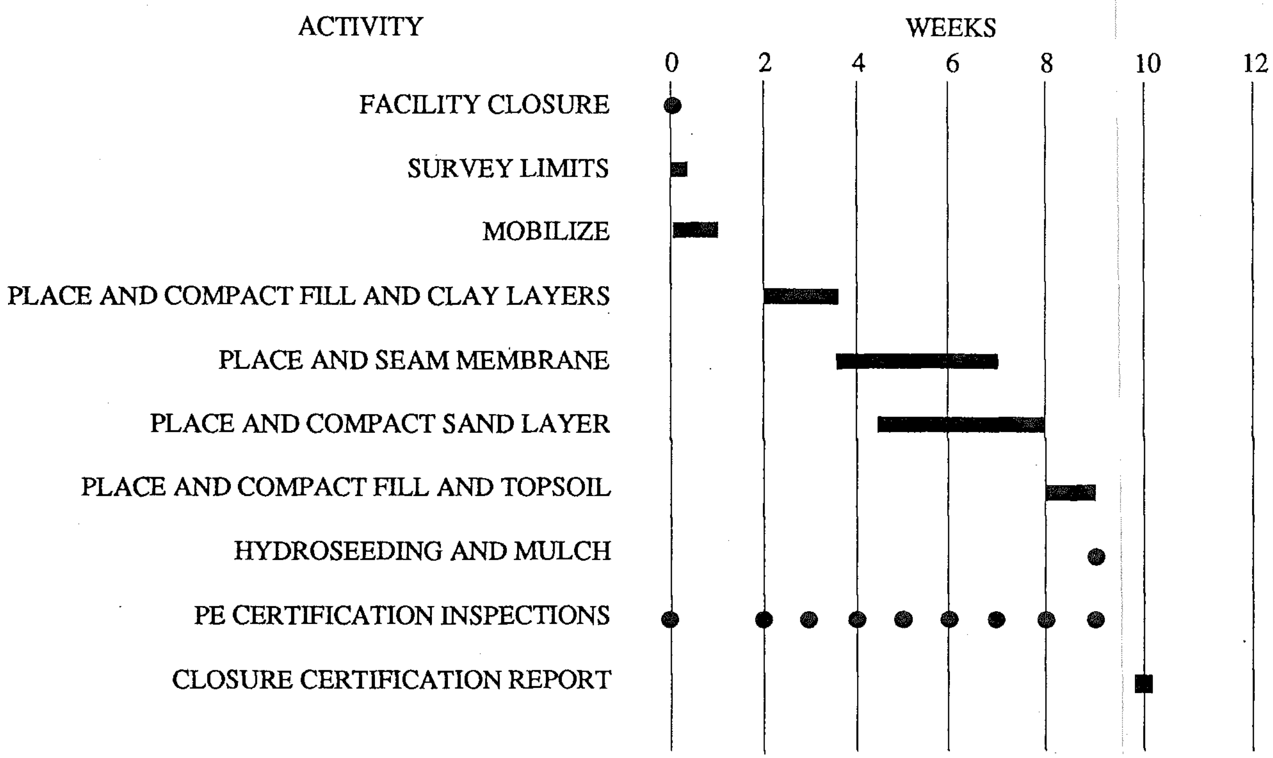

FIGURE 7-2

Closure Schedule for Floor Wash Water Impoundment

8. CLOSURE AND POST-CLOSURE COST ESTIMATES

8.1 Closure Costs

The closure costs presented here were estimated based on equipment and analytical services vendor quotes and the Means Cost Data for Site Work and Building Construction 1989 edition. Total closure cost for this facility is $5,582,702. This cost does not include groundwater monitoring-related installation since all wells either have been or are currently being installed. This estimate includes costs for the removal of wastes from and decontamination of the zinc-oxide bunker, as well as for capping the remaining three units. This cost does not include the dewatering equipment for the bunker; Chemetco will use existing dewatering equipment during closure of the bunker, if necessary. Labor and operation and maintenance costs are incorporated in the cost for removing the bunker contents. Table 8-1 summarizes costs for each unit.

8.2 Post-Closure Cost Estimate

Post-closure costs were estimated for the facility based on vendor quotes and the Means Building Construction Cost Data manual. Annual post-closure care cost is estimated at $62,700. This estimate includes groundwater sampling and analysis costs and well maintenance, as well as cap maintenance costs for the three land disposal units. There are no post-closure costs associated with the zinc-oxide bunker since it is a storage unit and will be clean closed. Post-closure costs are presented in Table 8-2.

TABLE 8-1

CLOSURE COST ESTIMATE

ZINC OXIDE BUNKER/PILE

Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]
Decontamination of Unit				
Open bunker wall to allow equipment access 8" reinforced concrete	SF	200	8.86	1,770
Remove ZnO contents from bunker using front end loader (3 CY wheel-mounted)	CY	63,000	.70	44,100
Transport to Reclamation Facility	Ton	63,000 (assume same volume)	60.00	3,780,000
Scrape and sweep bunker to remove residue (Chemetco equip.)	Day	2	500	1,000
High pressure wash to clean bunker (Chemetco equip.)	Day	3	500	1,500
High pressure wash to clean filter press and slurry tank system	Day	3	500	1,500
Analyze rinsate samples metals (Pb and Cd)	Sample	10	35	350
Decontamination of Adjacent Area				
Sweep concrete pad	Day	2	500	1000
Drill concrete - 4" diameter 8" reinforced concrete	Each	5	30	150
Collect soil samples 24 samples with hand auger	Day	1	600	600
Analyze soil samples	Each			
total metals (Pb & Cd)		24	45	1,080
E.P. toxicity (Pb & Cd)		12	80	960

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TABLE 8-1 (Continued)

Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]
Excavate contaminated soils with backhoe (3 CY hydraulic backhoe)	CY	20		300
Transport to Reclamation Facility	Ton	100	60	6,000
Backfill excavation with slag (75 HP, 50' haul, sand and gravel)	CY	20		300
			Subtotal	3,840,540
			20% Contingency	768,108
			10% Administration	384,054
			Subtotal	4,992,701

COOLING WATER CANALS

	Closure Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]
1.	Dewater open sections of canal with 4" pump, 8 hr/day, attended 2 hr/day.	Day	3.0	110	330
2.	Remove east drying pad	SF	5,000	3.4	17,000
3.	Place and compact fill to establish cover base elevations	CY	8,000	7.5	60,000
4.	Place and compact clay layer	CY	8,200	10	82,000
5.	Place and compact topsoil layer	CY	5,500	15	82,000
6.	Hydroseed and mulch	SY	16,000	0.35	5,600
7.	Engineering oversight (70 days)	Hr	560	60	34,000
8.	PE Certification (15 days)	Hr	120	80	9,600
			Subtotal		290,000
			20% Contingency		58,000
			10% Administration		29,000
			Subtotal		$380,000

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TABLE 8-1 (Continued)

ZINC OXIDE LAGOONS

	Closure Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]
1.	Place and compact fill to establish cover base elevations	CY	3,000	7.5	23,000
2.	Place and compact clay layer	CY	2,000	10	20,000
3.	Place and compact topsoil	CY	1,300	15	20,000
4.	Hydroseed and mulch	SY	3,900	0.35	1,400
5.	Engineering oversight (20 days)	Hr	160	60	9,600
6.	PE Certification (6 days)	Hr	48	80	3,800
			Subtotal		78,000
			10% Administration		7,800
			20% Contingency		15,600
			Subtotal		$100,000

FLOOR WASH WATER IMPOUNDMENT

	Closure Activity	Unit	Quantity	Unit Cost[1]	Total Cost[2]
1.	Place and compact backfill	CY	1,200	7.5	9,000
2.	Place and compact clay	CY	1,200	10	12,000
3.	Place and seam membrane	SY	1,800	5.0	9,000
4.	Place and seam fabric	SY	1,800	1.4	2,500
5.	Place and compact sand	CY	600	15	9,000
6.	Place and seam fabric	SY	1,800	1.4	2,500
7.	Place and compact fill	CY	900	10	9,000
8.	Place and compact topsoil	CY	300	15	4,500
9.	Hydroseed and mulch	SY	1,800	0.35	630

TABLE 8-1 (Continued)

10. Engineering oversight (35 days)	Hr	280	60	17,000
11. PE Certification (9 days)	Hr	72	80	5,800
	Subtotal			81,000
	20% Contingency			16,000
	10% Administration			8,100
	Total			$110,000
	Total Closure Costs			$5,582,702

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[1]Unit costs are based on <u>Means Building Construction Cost Data, 1989</u> vendor prices, and standard labor rates.

[2]All total costs are rounded to the nearest dollar.

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TABLE 8-2

POST-CLOSURE COST ESTIMATE FOR FACILITY

	Post-Closure Activity	Unit	Annual Quantity	Unit Cost*	Annual Cost*
1.	Cover inspection and weeding	SY	43,000	0.10	4,300
2.	Cover repairs (fill and seed)	SY	1,100	6.6	7,260
3.	Fence repair/replace	Ft	150	10	1,500
4.	Ground-water Sampling	Day	16	250	4,000
5.	Groundwater Analysis (Pb, Cd, Cu, Sn, Cr, As, Zn, TOC, TOX)	each	128	200	25,600
6.	Monitoring well repair/replace	each	1	3,000	3,000
7.	PE Certification	Hr	32	80	2,560
	Subtotal				48,220
	10% Administration				4,820
	20% Contingency				9,640
	Total				$62,700

*Costs in 1989 dollars. Unit costs from Means manual and vendor quotes.